TECHNOLOGY DEPT.

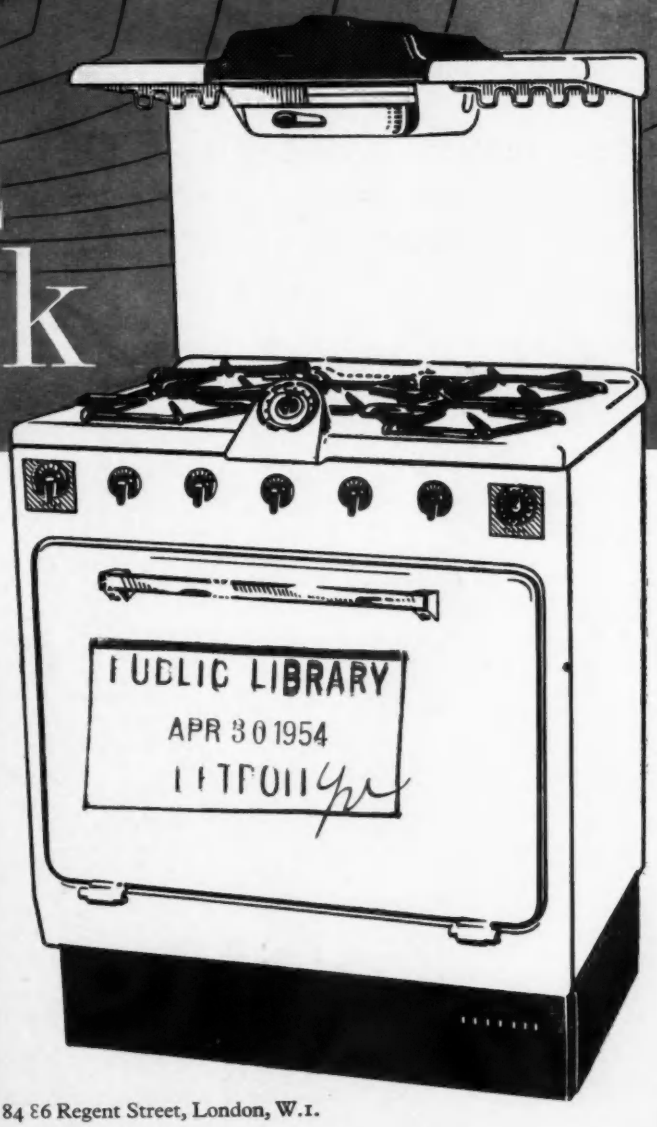
Gas Journal

VOL. 278 106TH YEAR. LONDON, APRIL 14, 1954 NO. 4741. PRICE 1/3

DE LA RUE GAS COOKERS

Looking forward

The new DE LA RUE Warwick



The Cooker that started everyone talking at the Ideal Home Exhibition —the De La Rue "Warwick" looks forward in every feature of modern design

The De La Rue "Warwick" will soon be available—and your customers will be wanting to see it

- New colour scheme
- 5 hotplate burners
- Eye-level grill and plate rack
- Double size oven
- Hinged hotplate for easy cleaning
- Drop-down oven door

THOMAS DE LA RUE & CO. LTD. (*Gas Division*), Imperial House, 84 86 Regent Street, London, W.1.

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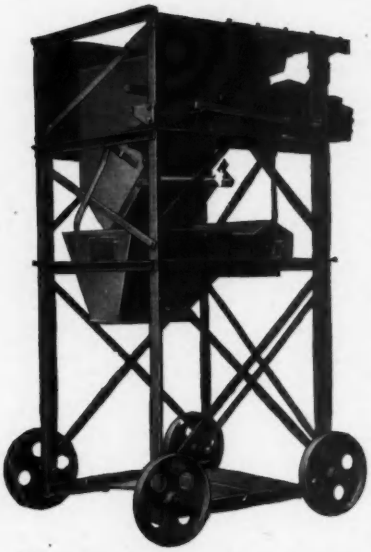
THE SIMON PATENT AUTOMATIC COKE WEIGHER

Approved by the Board of Trade and stamped by the Weights and Measures Authorities.



Capacity: 28 to 112 lbs. per discharge (nett).

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Guaranteed accuracy and continuity of operation.

Machines may be seen working by appointment.

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DONKIN HANSON AUTO-PILOT GOVERNOR

FOR USE WITH STATION GOVERNORS

THIS PILOT GOVERNOR IS OPERATED BY AN EIGHT-DAY CLOCK, AND CHANGES THE PRESSURE TO MEET PEAK LOADS, ACCORDING TO REQUIREMENTS. A DIFFERENT LINE CAN BE GIVEN FOR EACH DAY OF THE WEEK IF REQUIRED.

The BRYAN DONKIN CO LTD · Chesterfield

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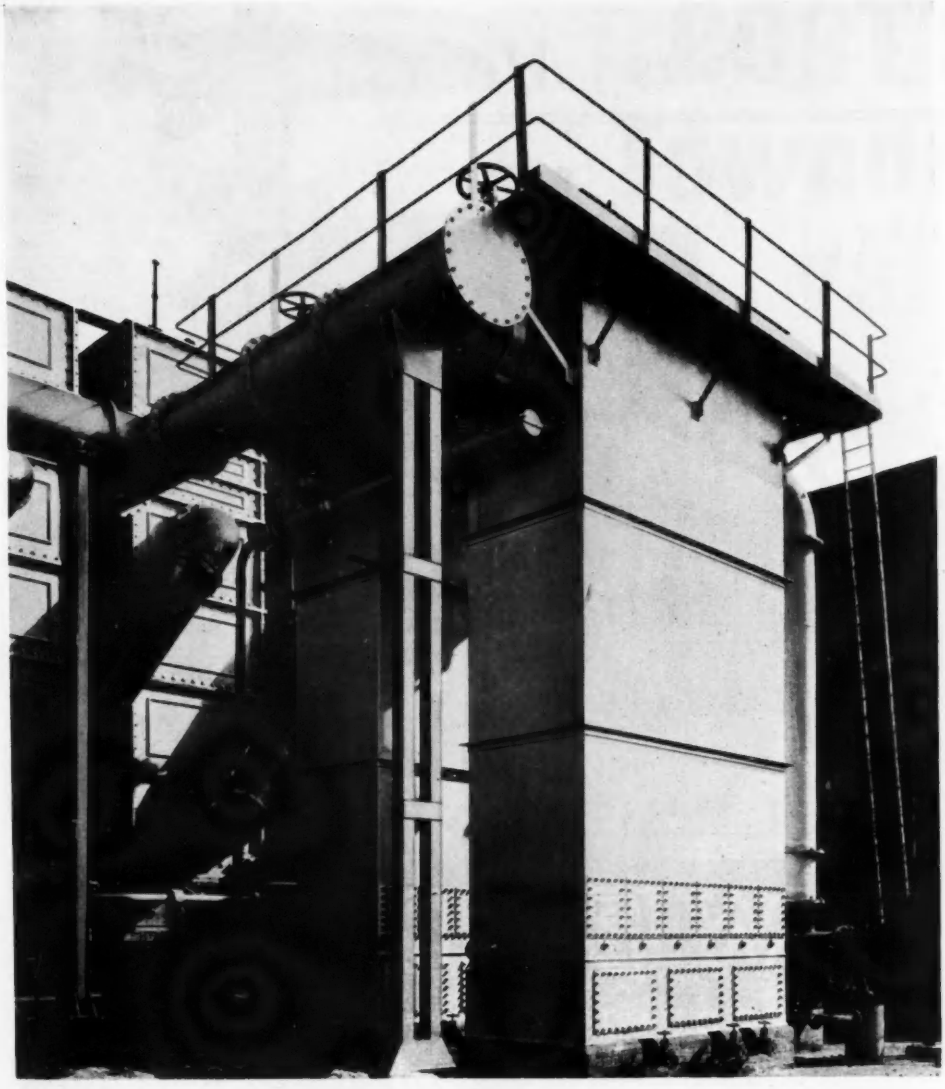

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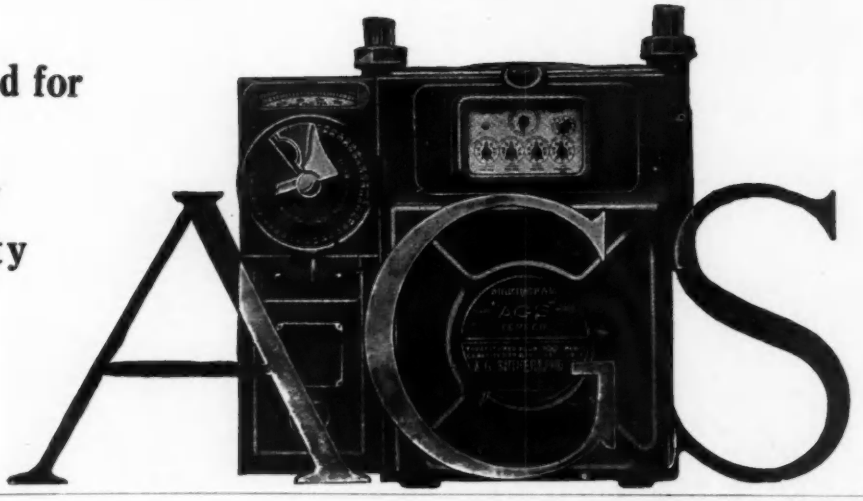

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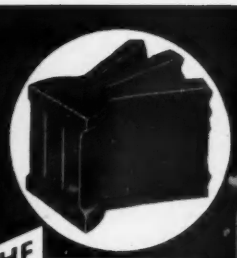
GAS INDUSTRY



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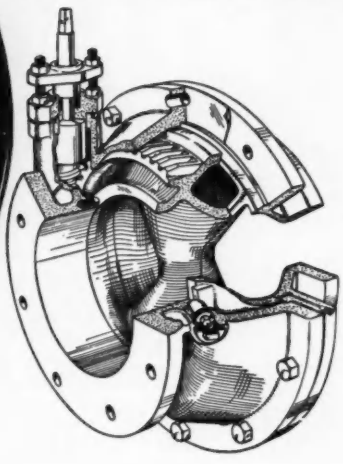
CORT'S "Towndrow" valve



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ALL WORKING PARTS sealed from the gas stream.

MATING FACES of the gate and seat always in contact, clean and greased.

ADJUSTABLE WEDGES ensure equal distribution of pressure on the gate.

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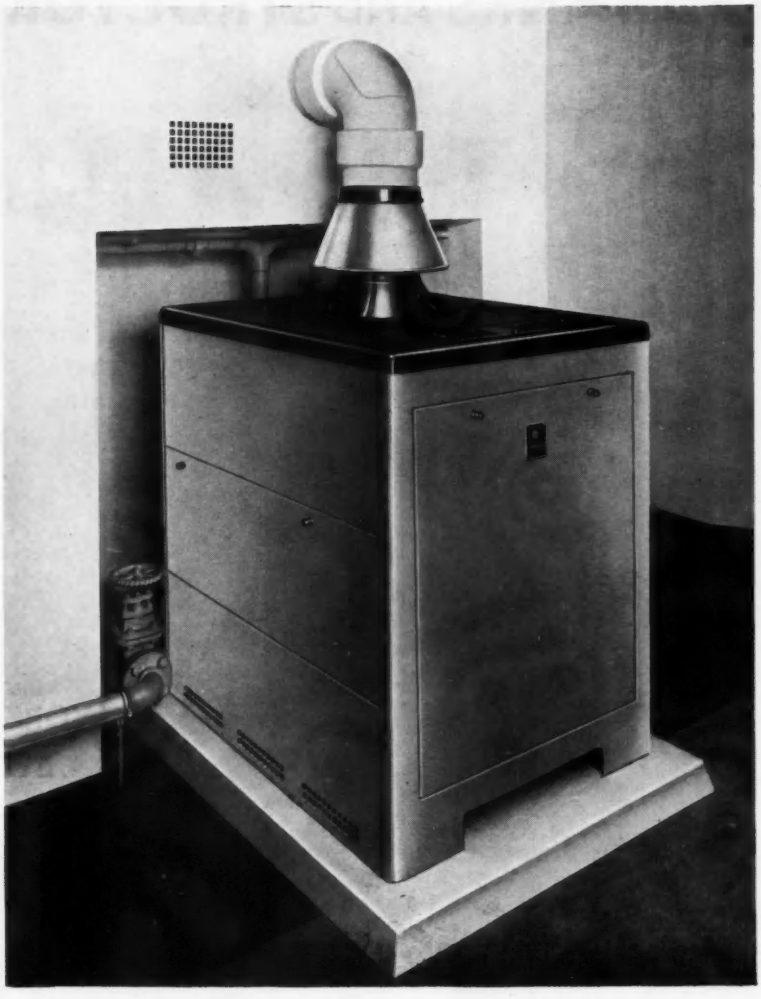

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Efficient, labour-saving, clean and trouble-free, the Ideal Gas Boiler is fully automatic—an economical investment. In new buildings, or in buildings being modernised ; where space is limited for fuel storage, and labour not available for stoking ; Ideal Gas Boilers are essential, providing a constant temperature in heating and hot water supply. Smokeless too, they meet the urgent need for heating equipment which will not pollute the atmosphere. In a range of 22 sizes, from 20,000 to 1,430,000 B.T.U.'s per hour, Ideal Gas Boilers are completely thermostatically controlled and have insulated jackets of steel or aluminium in appropriate finishes.

They are the result of long experience and much research in this specialised type of heating and their growing popularity is a measure of their success.

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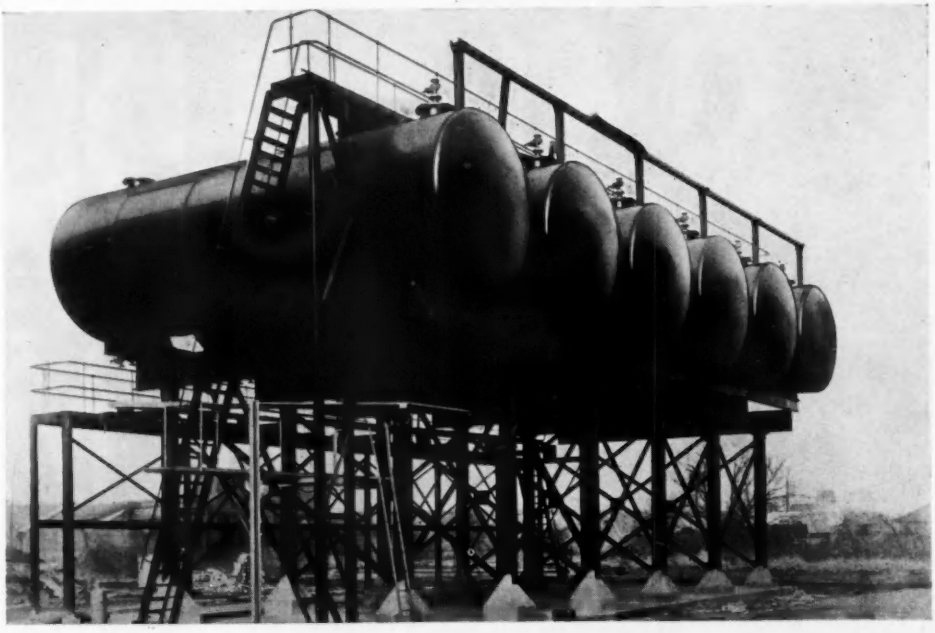

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188

Eliminate constantly burning by-passes

and reduce Public Lighting costs by installing Newbridge 'Comets'

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a HORSTMANN product

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The **PERFORMANCE IS CONSTANT** and the life of the meter long, due to the use of high quality materials, design and workmanship.

PRESSURE ABSORPTION
at a flow of 200 cu. ft. per hour on air is ONLY 0.3" W.G.

PERFORMANCE

VARIATION
in registration between 10 cu. ft. per hour and 300 cu. ft. per hour is considerably **LESS THAN 1%.**

The performance is **EQUAL TO THE D.2. TYPE OF METER**

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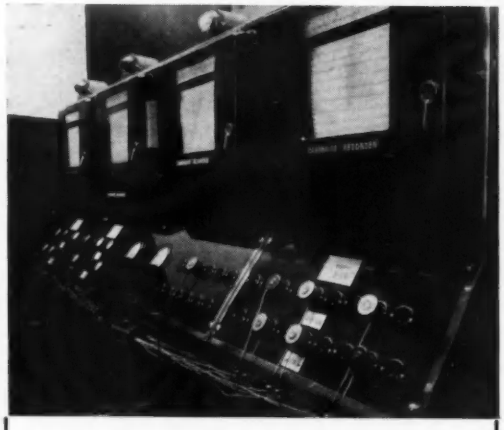
A Brick by any other name...



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The temperature control panel at West Hunwick is centrally situated so that each kiln temperature schedule is under immediate inspection. The least deviation can, therefore, be immediately detected and corrected.

A Hunwick Silica brick may **look** the same as any other Silica brick.

But the only Silica brick which is really the same as a Hunwick Silica brick is any other Hunwick Silica brick and between those—all the hundreds of thousands of them—there is no difference at all. One is as good as any other, all are as good as the rest.

This **consistency** is maintained only because the control at our works is evident at every stage of manufacture. There is no room for human error, no possibility of deviation between the quality of one brick and the next.

That is a point to bear in mind when specifying Silica bricks. It is good to know that not a single Hunwick brick in a million could possibly let you down.

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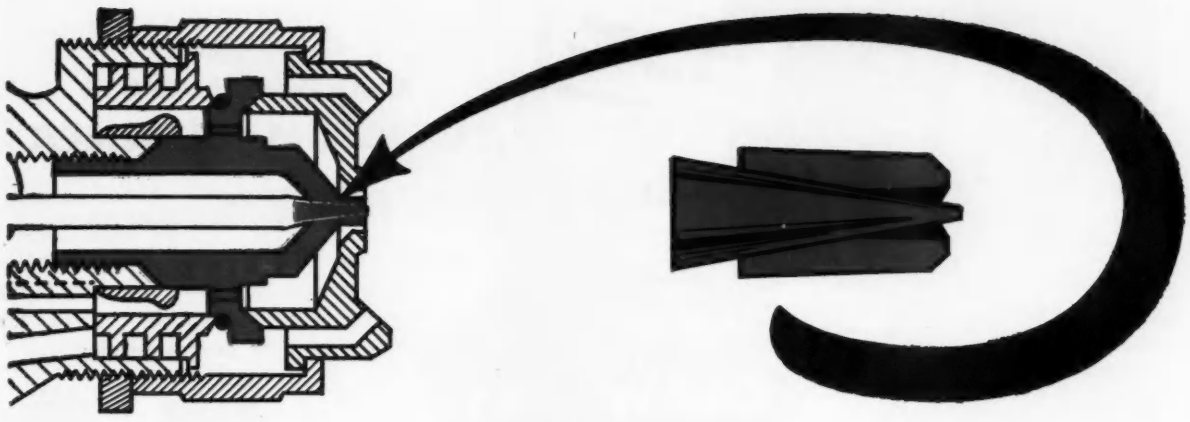
THE WEST HUNWICK SILICA AND FIREBRICK COMPANY LIMITED

HUNWICK, WILLINGTON, CO. DURHAM. Tel. CROOK 200.



abrasive materials spelt ruin to spray guns

—until DEVILBISS·AEROGRAPH introduced

NITRA-ALLOY

NOZZLES AND NEEDLE TIPS

With highly abrasive finishing materials, it is the nozzle and needle-tips that take the punishment. DeVilbiss·Aerograph supplied the answer — Nitra-Alloy, which greatly increases the life of guns used for spraying vitreous enamel etc. On all spray equipment, you keep that extra jump ahead that means really competitive production, if you standardise DeVilbiss·Aerograph spray guns and ancillaries. Write for the full descriptive catalogue 20J.

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—an outstanding advance in heavy duty high-speed gun design. For quality finishing with all types of material. Can also be supplied with *stainless steel* inserts for resistance to corrosive materials.

TYPE DCA

—particularly suitable for spraying small quantities of heavy materials at low pressure. Can be supplied with brass body for use with vitreous enamel and similar abrasive materials.

TYPE VFS

—an easy-to-handle gravity-feed gun, specially designed for producing mottled effects.

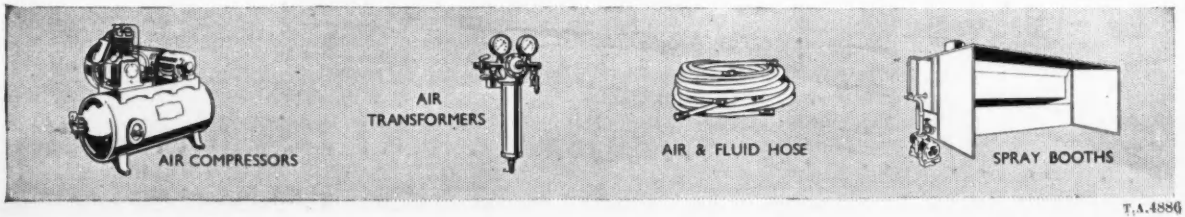
The SYMBOL of SERVICE

Spray Equipment for vitreous enamelling

DEVILBISS AEROGRAPH

Sets the pace in spraying

The Aerograph Co. Ltd., Lower Sydenham, London, S.E.26. Telephone: Sydenham 6060 (8 lines)



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REMOVES HOT SOOT AND ASH

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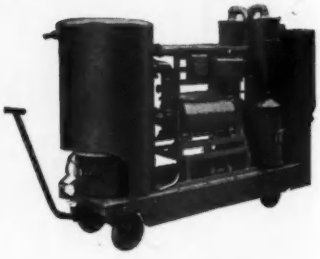
Model T.87 has been specially designed to be of maximum service in gas works. It is a highly efficient, large capacity, mobile unit with a water cooled container for receiving hot dust and smouldering ashes. Can be used by up to four operators for surface cleaning.



B.V.C. FLUE DUST REMOVAL PLANT used by: North Thames Gas Board (Beckton Nine Elms, Southall, Brentford and Stepney) West Midlands Gas Board (Birmingham) Wales Gas Board (Cardiff). North Western Gas Board (Birkenhead). Southern Gas Board (Reading). Etc. Etc.

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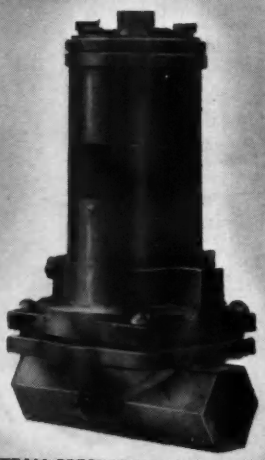
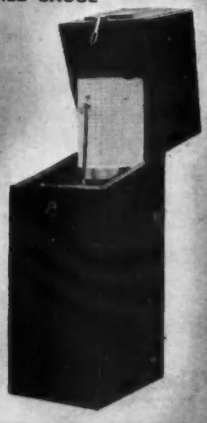


STEAM PRESSURE OPERATED GAS CONTROL VALVE

RELAY VALVE



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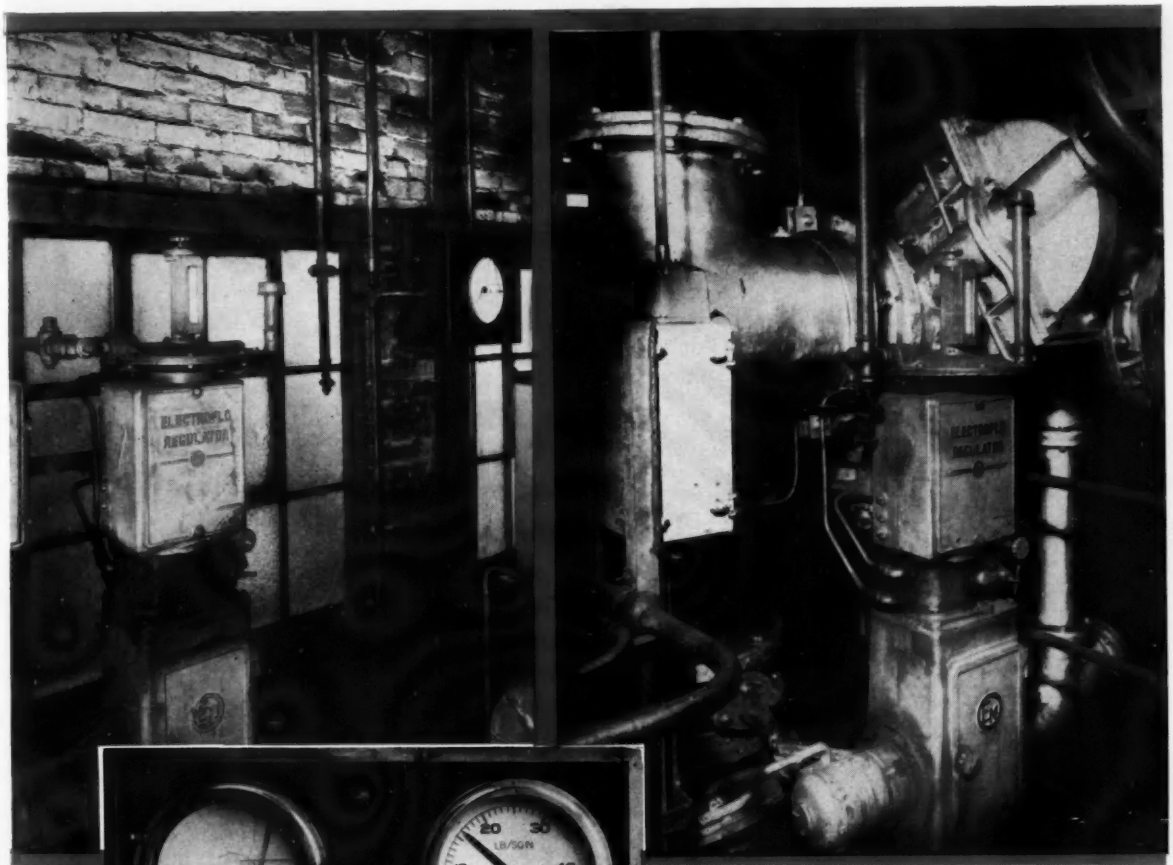
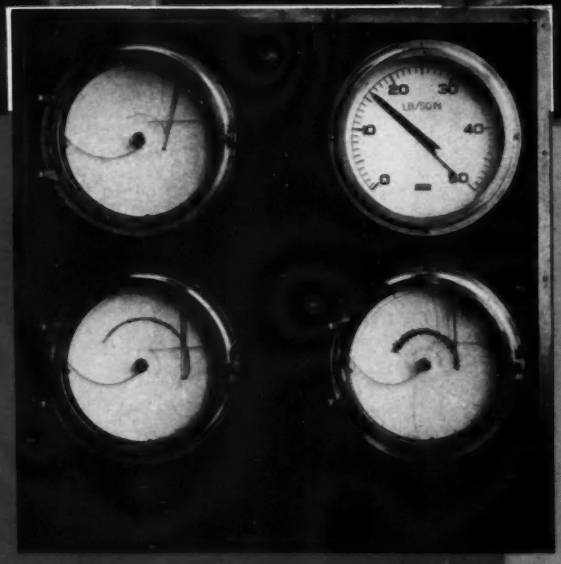
and associated companies in Europe, Australia, New Zealand, South Africa and South America.





Above (left): Automatic Producer Control. Pressure (and volume) in the common CO main is maintained constant by accurate throttling of the air blast to the producer bank.

Above (right): Hydraulically-operated Retort House Governor. This ultra-sensitive, self-contained governor responds immediately, without hunting, to ensure stable control under the most difficult and varied conditions of pull.

Inset: Typical R.H. Governor Instrument Panel. The records reveal pull conditions and governor action throughout the 24 hours. The indicator dial shows liquor pressure and a recorder measures vacuum in the Waste Gas Flue.

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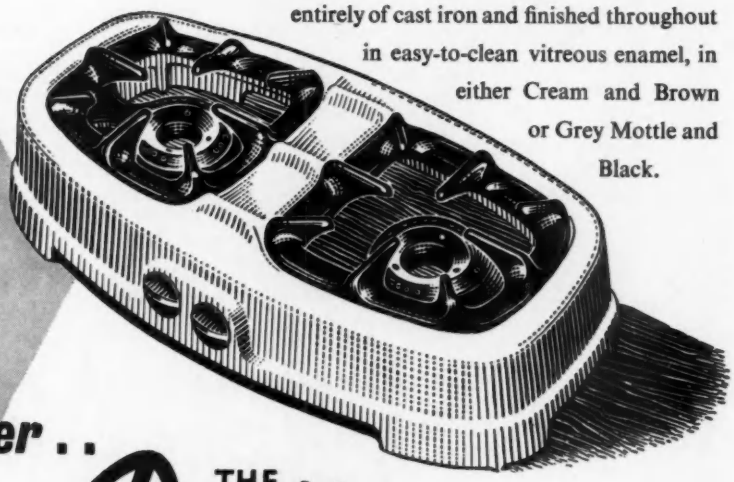
For the office..

the flat..

or the one-roomer..

This attractive hotplate has two boiling burners controlled by separate taps. Constructed entirely of cast iron and finished throughout in easy-to-clean vitreous enamel, in either Cream and Brown or Grey Mottle and Black.



THE Duette HOT PLATE

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The Steel Industry has broken records almost monthly and Peckett Locomotives, operating in Steelworks all over Britain, are hauling record loads. At the same time, Pecketts are constantly adding to their own fine record which has been sustained during 90 years of locomotive manufacture.

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CARBURETTED WATER GAS

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Designed and erected by

THE POWER-GAS CORPORATION LTD

STOCKTON-ON-TEES AND LONDON

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for small bronze valves

SIZES UP TO 3 in. BORE

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AUTOMATIC IGNITION
OF
DOMESTIC COOKERS
GAS REFRIGERATORS, FIRES, ETC

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use the STRONGEST, SAFEST METER LOCK

- **DON'T** buy locks you may have to scrap in a few years
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- **DON'T** think only of the present time; look to the future
- **DO** remember that good quality is cheapest in the long run
- **DO** take our word for it that our workmanship is consistently good
- **DO** profit by others' experience and use M. & M. Locks to protect your meters

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Hydraloader AND Hyaloader

THE **ONLY** LOADERS WITH FULL "POWER CROWD"

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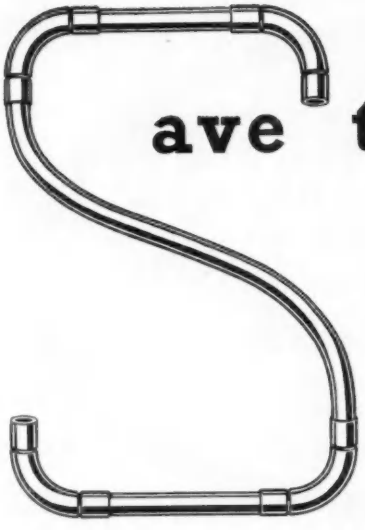

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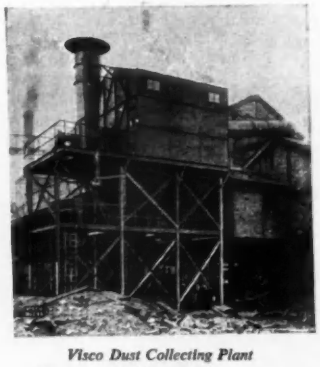

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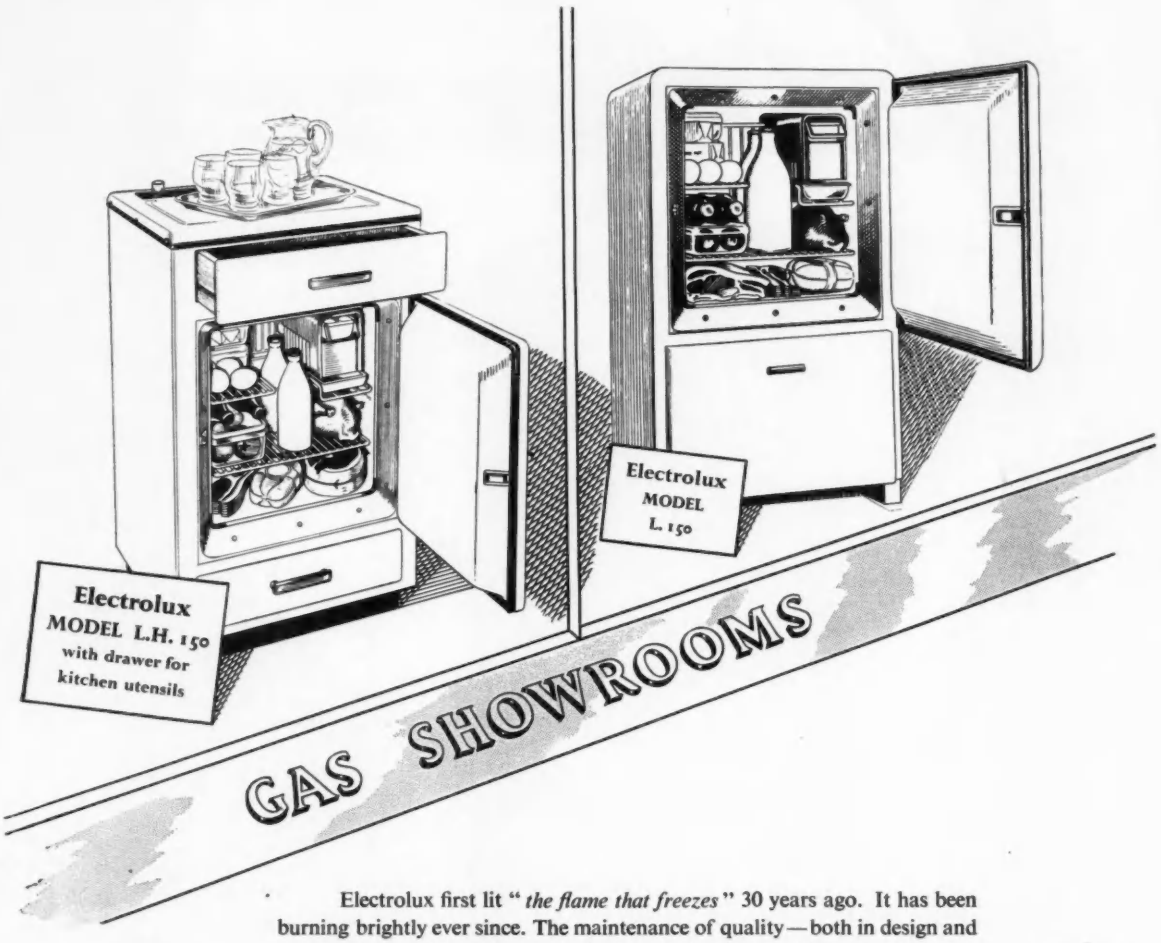

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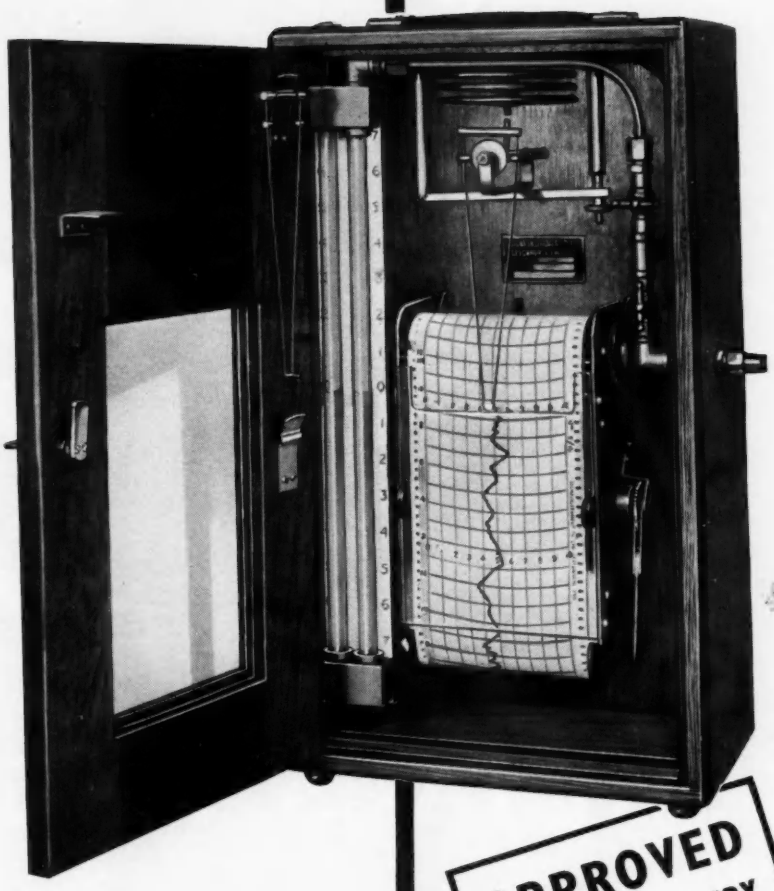

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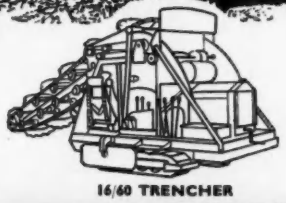

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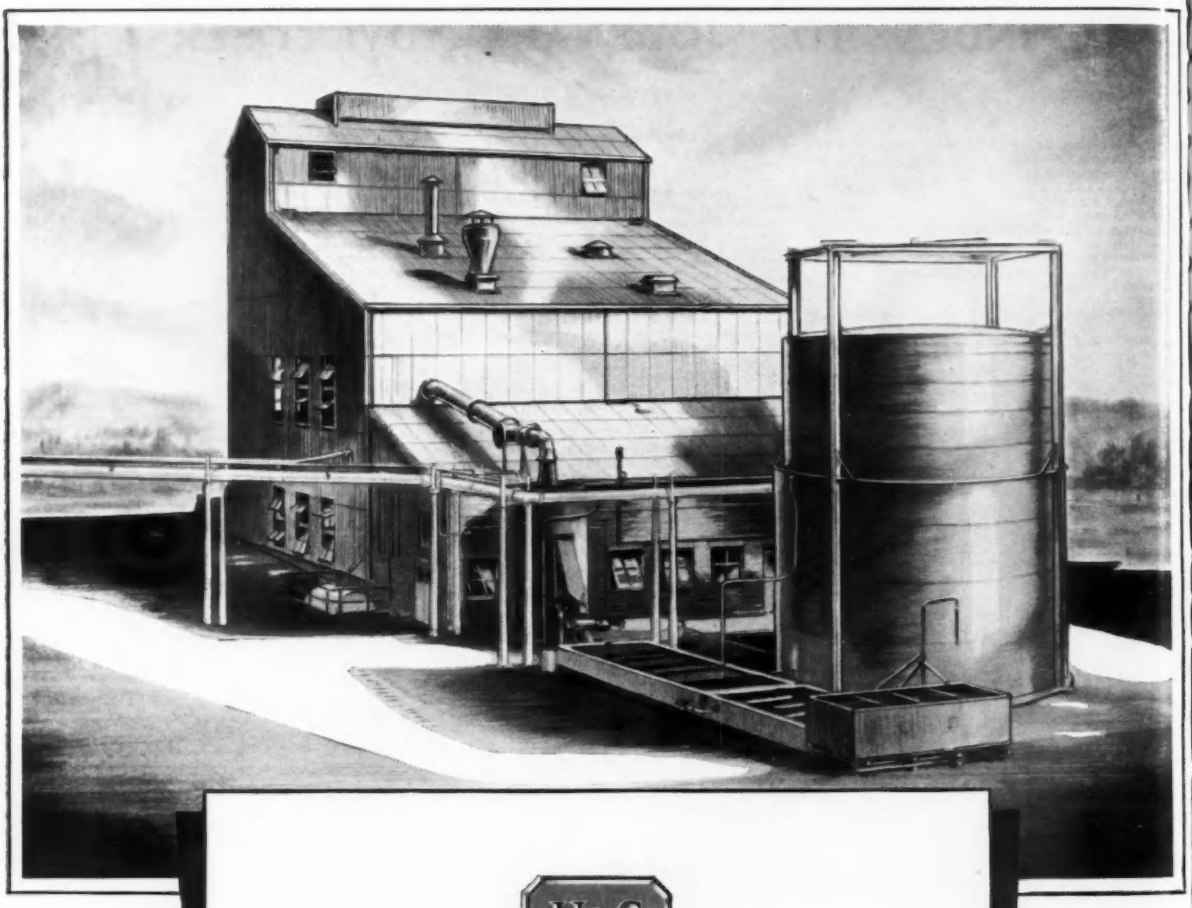

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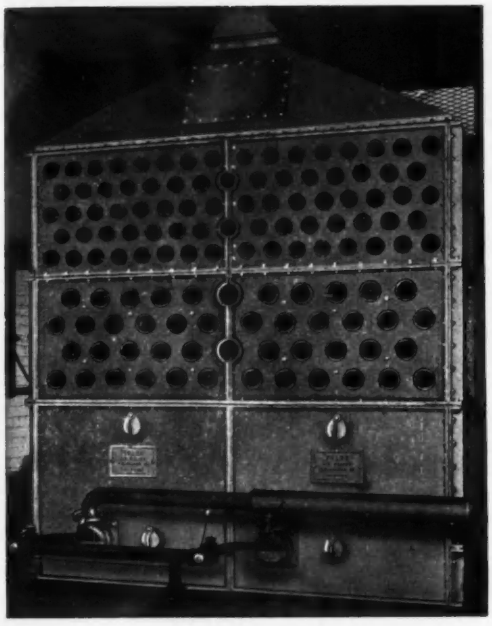

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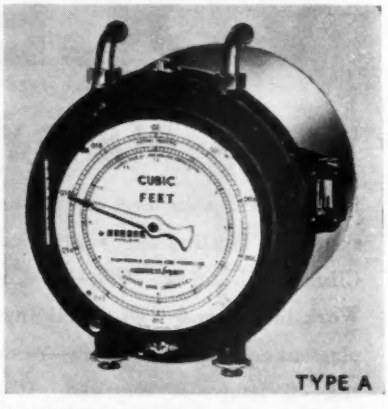

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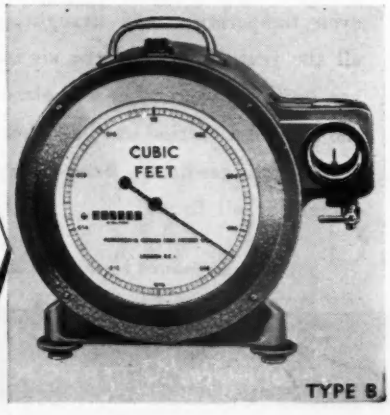

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Gas Journal

VOL. 278. NO. 4741 106TH YEAR April 14, 1954

THE CARRIER GAS IN C.V.R.

When John West and Mollwo Perkin were conducting in 1916-17 their exploratory tests with alternatives to steaming in the continuous vertical retort they may well have been struck by the extreme simplicity and safety of steaming as compared with any of the other gases they had in mind for injection at the base of the retort. Mr. M. S. Gaskill, in his paper under the title 'The Processing of Coal,' presented to the London Juniors on April 9, sets out, clearly and firmly, the precautions which must be taken when an inflammable gas is used as the 'carrier' to transfer heat from the residual coke to the incoming coal. It does not matter very much what you do about steam (it is left on in practice), but when you admit any of the recognised fuel gases, particularly those with a considerable carbon monoxide content, the safety of personnel demands a rigid adherence to a definite régime when the retort is opened to atmosphere at the bottom for the discharge of coke, an operation to be performed every hour or two. 'Purge steam on, carrier gas off, door opened, coke discharged, door closed, carrier gas on, purge steam off.' And interlocking gear must be provided so that this sequence is preserved.

Mr. Gaskill (whose paper will be found on p. 109) is describing investigations carried out and results obtained by West's at Miles Platting where they had the advantage of having one full-scale Glover-West vertical retort on which to operate. It was specially equipped with a water-sealed gas-tight bottom door so that leakage as a source of error at this point was eliminated. The retort is followed by a complete set of gasworks ancillary plant and the whole is fully equipped with every means of instrumental control and manned at every point by fully qualified staff. As far as they go, the results reported by Mr. Gaskill contain no element of uncertainty. For instance, the author warns us that the value of any general statement in regard to the economics of the process 'is considered doubtful,' though he does permit himself certain general observations to which speculators will no doubt return from time to time. His fully ascertained and quantitative facts are not very different from those reported by Messrs. Nicklin and Redman at Manchester recently.

In the main series of tests two forms of carrier gas were used, producer gas and water gas. Each test was matched with a comparable test when steaming the same type of coal to the same or nearly the same calorific value in the resultant gas. The outstanding feature of the results was the increase in throughput of coal and output in therms per retort per day. With round coals, throughput is more than doubled with both types of carrier gas. With water gas as the carrier, output is doubled, but with producer gas thermal output is reduced by the presence of inerts so that the increase is only of the order of 50%.

Tests of slack coals, Yorkshire and Durham, were carried out only with producer gas as the carrier. They showed that these slacks could be put through the retort at rates somewhat in excess of the rates obtained with nut coals of the same categories when steaming. Make per ton was substantially equal whether by steaming or with water gas as carrier gas—equal, that is, whether the water gas is made in the retort or injected from the outside—not a very surprising result. With producer gas as carrier, the yield is reduced, as was to have been expected. And here it may be noted that, when coal gas and mixtures of coal gas and water gas were utilised, while similar increases in throughput were obtained, appreciable degradation of the carrier gas occurred with resulting loss in thermal yield—not a very surprising result either.

It seems that so far the new technique is attractive only when making gas for sale of the order of 450 B.Th.U. per cu.ft. But West's researchers carried out one pair of trial runs when making gas at a high calorific value. They made a run with minimum steaming, which produced a gas at 526 B.Th.U. per cu.ft., and then they re-cycled coal gas to give the same resulting calorific value. Throughput went up from 5 to over 8 tons, output from 335 to nearly 500 therms, but make per ton came down from 65 to 57 therms. The carrier gas (re-cycled coal gas) was not debenzolised. And here follows the significant remark that in the original patent of the West-Perkin process (not a bad appellation, we suggest) stripped coal gas was specified as one of the possible carrier gases. It seems clear that West and Perkin anticipated, and it is possible that they had proved in practice, that degradation of normal coal gas would occur when passing through hot coke.

There is then available a certain body of ascertained fact. Scrutiny and analysis may elicit a certain body of reliable deductions. But until we get a new plant

designed to implement these ideas we question whether anyone will be able to say with certainty whether we are in sight of a substantially cheaper gas therm.

Arguing on the results now before us it would seem that three types of carrier gas have been pretty thoroughly investigated, producer gas, coal gas (or somewhat similar gas), and blue water gas. It would seem that producer gas depresses the calorific value of the finished gas considerably; that coal gas, or other rich gas, though apparently necessary if a high resultant calorific value is required, would be degraded to a degree to influence the economics of the process. There remains blue water gas, and this would appear to be successful with some of the limitations of steaming—mainly, that it would only be economical if a relatively moderate calorific value is acceptable in the final gas.

Coming to practical application and applying the process to existing installations, the doubling of coal throughput and coke output is bound to present some problems. The former may mean either doubling the storage of coal above the retorts or increasing hours of coal handling with, in some cases, the re-introduction of week-end labour where this has hitherto been avoided. The latter may mean either new coke receiving chambers of double the capacity or shortening the interval between discharges—a serious matter when combined with a more complicated technique of discharge and the need for a greater intensity of supervision to ensure safety.

No doubt these and allied problems can be solved in plant specially designed to exploit the new proposals. And in any case it would seem to be only in the study, design, and operation of new plant that firm decisions about the economics of the process can be taken.

WIT, INTELLIGENCE, AND BREVITY

We have already recorded the success of the Comprehensive Refresher Course for senior works engineers which closed at Leeds University last month. We may recall that it was the latest of the series organised by Incorporated Plant Engineers through its Education Committee, this time in conjunction with leading West Riding industrialists. It had been sponsored by Sir Hubert Houldsworth, Pro-Chancellor of the University, and it lasted for 20 weeks. In his address at the closing session Sir Hubert expressed the view that a man who has good scientific training in current conditions is rendering a far greater service to the community if he goes out into industry and lessens the vast gap between discovery and application of knowledge. He is far better employed that way than what could frankly be called humdrum researches of no particular value or interest to industry. It is given to few to possess a really original mind. Those few can be well employed in searching for new knowledge. They are able to conduct that search with skill and success. It is a matter of importance that encouragement should be given to those who are good, without being the real cream of original thinkers, to go into industry to apply what is already known. And it must not be forgotten that progress revolves more around individuals than it does around organisation.

At the same session a stimulating address—indeed, quite a remarkable psychological dissertation—was also given by Sir Oliver Lyle, surely an original thinker and well known to the gas industry for his passionate and practical interest in all aspects of fuel economy. We do not intend here to recount in any detail the many vital points which he discussed; but we would refer to one matter in which we are specifically interested and on which we have commented at some length in these columns. Sir Oliver asked how the young engineer approaches the task of selling his ideas—it may be on extensions, improvements, or alterations—to the manager. Will the young engineer present his chief with a voluminous paper, a sort of thesis, or will he talk to him first and then follow-up with what we will term 'refresher notes,' to keep his memory green on the subject.

A manager, said Sir Oliver Lyle, is like an engineer 'only more so.' He is swamped, suffocated, knocked sideways by a flood of paper. If the manager read everything he is supposed to read he would have no time to eat, sleep, or work. Hence Sir Oliver's advice that the junior engineer should not pester his chief with theses—those windy arguments of the immature mind. Rather should he explain his points orally in a straightforward way and let him have a brief report to sharpen his memory. It is, of course, necessary to have any scheme in writing. Sir Oliver Lyle's plea, which we so wholeheartedly support, is that, in writing, the engineer should marshall his arguments, arrange them in logical order, cut out the padding, and crystallise the ideas. And it is in fact strange to contemplate how many men who talk in quite a straightforward, simple way, can do no better than write in stilted, pompous bilge.

SUNSHINE ON TAP

Nuclear fission as a horrifying menace to civilisation and as a source of comfort to humanity is major topic of the day. Fuel economy problems arising directly, not necessarily from shortage of the fuels themselves, but from the ever-rising costs of harnessing the available fuels for use, have attracted attention to the employment of direct solar radiation. This project, as pointed out a few days ago by Dr. H. Heywood, Reader in Mechanical Engineering at the Imperial College of Science and Technology, is by no means new, but Britain's cheap supply of coal has until recent years nullified the economic incentive for the direct use of solar energy. It is well established that coal and oil are highly concentrated products of the fixation of solar radiation; water power is also concentrated solar energy. It has also been established that the technical problems of converting solar energy to the low-grade heat we need in the home have been solved. Four years ago Dr. Heywood installed at his home at Sidcup a 'water heater' of 10 sq. ft. area. This solar heat absorber was constructed from two sheets of corrugated galvanised iron placed in 'mirror image' position. The metal absorber with blackened front section was enclosed in a wooden casing with heat insulation at the back and with two layers of glass over the front. A hot water storage tank was added to make the whole a thermo-syphon circulating system. Results of tests have shown that small absorbers in the British Isles are effective for about two-thirds of the days in the months from April to August or September, and that, over such a period, 'in rural areas could be an economical proposition.' There has as yet been no attempt to combine the solar heat absorber with the heat-pump system. Such a combination might well open up new fields of application.

Mr. Alex W. Lee, formerly General Manager and Secretary of the Birmingham Gas Department and latterly Deputy Chairman of the West Midlands Gas Board, acknowledges the presentation that was made to him at the Midland Juniors President's Day on his retirement after 47 years in the gas industry. A report of the presentation was published in the 'Journal' last week.

Personal

MR. JOHN BOYD, principal collector and cashier with the Arbroath office of the Scottish Gas Board, retired at the end of March. He started as a clerk in the office of the Arbroath Gas Corporation in 1911, and was appointed principal collector and cashier in 1924.

MR. R. S. RAMSDEN, formerly Manager of Leamington Priors Gas Co. and a founder member of Leamington Rotary Club, has been elected to honorary membership in appreciation of his work in the movement. He is now living in retirement at Lymington, Hampshire.

MR. WALTER MASON, Manager at Oakham, Rutland, has been presented with a gold watch by Mr. H. B. Taylor, Divisional General Manager, East Midlands Gas Board, to mark his 48 years in the gas industry. Mr. Mason's father was Manager at Oakham from 1890 until 1917 and Mr. Mason himself was born in the house at the gasworks in which he still lives.

MR ALEX G. PAVELEY, of the North Middlesex District, has retired after half a century of service with the North Thames Gas Board. The whole of his service has been spent in the one district, Mr. Paveley having joined the former North Middlesex Gas Company in 1904. After a month in the Finchley showrooms, he went as an office boy to the Mill Hill works, becoming clerk-in-charge in the works office in 1912. During the first world war, Mr. Paveley served in Egypt with the Royal Army Veterinary Corps. On demobilisation he resumed work in the stores, controlling both the works and district stores. In 1925 he was appointed Stores Superintendent at Finchley, and it was there that he remained for the remainder of his service. To mark his retirement, Mr. L. C. S. Poulter, North Western Divisional Manager, presented Mr. Paveley, on behalf of his friends and colleagues, with an armchair and a parchment scroll containing more than 150 signatures. A bouquet was also presented to Mrs. Paveley on behalf of the Social Club.

MR. JOHN M. BROWN, of Perth, has been appointed Technical Assistant at the Scottish Gas Board head office in Edinburgh. He is 29 years of age and has been Assistant Gas Engineer at Rochdale for three years.

MR. GEORGE BEAVEN, Warehouse Manager at the North Thames Gas Board's stove department, Harwood Terrace, Fulham, retired at the end of March after 41 years service. He joined the former Gas Light and Coke Company in 1912 as a clerk in the stores department. In 1933 he was appointed chief stores clerk at Stratford, and four years later was transferred to the stove department at Fulham. To mark his retirement Mr. Beaven was presented by Mr. E. W. Hobbs, Manager of the department, with three golf clubs subscribed for by his friends and colleagues. Previously the Harwood Athletic Club, of which Mr. Beaven had been Chairman for 15 years, had presented him with a golfing bag, and for Mrs. Beaven, who accompanied him, there was a bouquet.

Obituary

MR. FRANCIS A. CHEESEMAN, Divisional Sales and Service Manager of the South Eastern Gas Board's West Surrey Division, died on April 5, at the age of 45 years. He was educated at Emanuel School, Wandsworth, and entered the Mitcham office of the former Wandsworth and District Gas Company in 1925. From 1928 to 1935 Mr. Cheeseman was personal assistant to the Sales Manager, and sales promotion assistant from 1935-43. In 1946, after three years as Domestic Service Manager, he was appointed Sales Manager to the Company. When the industry was nationalised, he was appointed Sales and Service Manager and a Principal Officer of the West Surrey Division of the South Eastern Board. Mr. Cheeseman was a Member of the Institution of Gas Engineers and of many other professional bodies. He was made a Freeman of the City of London in 1950 and was a past President of the Rotary Club of Putney, with which he had been associated for many years.

Diary

April 16.—SCOTTISH JUNIORS (Western): Annual General Meeting.

April 22.—WALES AND MON. JUNIORS: Annual General Meeting. Presidential Address and Paper. Aberystwyth.

April 27.—MIDLAND JUNIORS: Annual General Meeting, Staff Mess Room, Birmingham.

April 28.—MANCHESTER JUNIORS: Visit to the Stanton Ironworks Co., Ltd., Nottingham. 'Some Aspects of Grid Distribution.' K. Summersgill, North Western Gas Board.

April 29-30.—EAST MIDLANDS GAS BOARD: Staff Conference, Skegness.

April 29.—NORTH THAMES G.C.C.: Caxton Hall, Westminster.

April 30.—MANCHESTER AND DISTRICT SECTION, I.G.E.: Annual General Meeting. Chairman's Address, H. Johnston, Chief Engineer, North Eastern Gas Board; at Manchester.

May 4.—EAST MIDLANDS G.C.C., Victoria Station Hote', Nottingham, 11.30 a.m.

May 4.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster, 11 a.m.

May 5.—YORKSHIRE JUNIORS: President's Day: Visit to Moor End Gasworks, Cleckheaton, 11 a.m.; British Belting and Asbestos, Ltd., Cleckheaton, 2.30 p.m.

May 7.—LONDON JUNIORS: 'Gas in the Sugar Industry,' H. Capper, Divisional Industrial Representative, South Eastern Gas Board, 178, Edgware Road, 6.30 p.m.

May 8.—SCOTTISH JUNIORS (EASTERN): Visit to Dumbarton Gasworks.

May 8.—EASTERN JUNIORS: Annual General Meeting to be followed by afternoon visit. Ladies invited. Harwich.

May 13.—LONDON JUNIORS: Whole-day visit to Ciment-Fondu Works.

May 13-14.—WALES AND MONMOUTHSHIRE SECTION, I.G.E.: Spring Meeting, Porthcawl.

May 15.—SCOTTISH JUNIORS (EASTERN): Annual General Meeting, Edinburgh.

May 17.—EASTERN G.C.C.: Connaught Rooms, Great Queen Street, Kingsway, W.C.2, 2 p.m.

May 17-18.—EASTERN SECTION, I.G.E.: Annual General Meeting. 'The Development of Safety Measures in the East Midlands Gas Board,' D. W. Ault. Skegness.

May 18.—LONDON AND SOUTHERN SECTION I.G.E.: Spring Meeting, Chairman's Address and Annual Luncheon.

May 19-20.—GAS SALES AND SERVICE CONFERENCE. Floral Hall, Southport.

The West Midlands Gas Board's Stand at the National Trade and Home Life Exhibition, Birmingham, displays a wide range of gas appliances. Of modern design, with simple and clean lines, in a central position in the main hall, the Stand is ideally placed. As many of the other stands are mediocre in design, the stand is a centre of attraction and draws a steady stream of visitors. The Electricity Board has spared no expense and has taken the entire space in a smaller hall adjoining. Its stands are well designed but the entrance to the hall is such that many visitors are unaware of its existence, and undoubtedly the Gas Board's stand is doing more business and certainly getting more publicity.

Correspondence :. The 'Rochdale' Process

Sir,—The authors are to be congratulated on their description of a most important piece of work. As they are clearly aware, it is likely to have influences in several directions, and many aspects receive comment either in the paper itself or in the extensive discussion. There are three points, however, which might be underlined—namely, the essential difference between the injection of gas and steam, the possibility of re-cycling coal gas, and the flexibility which is bestowed on the carbonisation process.

The results show that the important feature of using gas to recuperate heat carried downwards in the coke is that gas does not, like steam, absorb heat by endothermic reaction in the carbonising section. In consequence it can be exploited to increase materially the throughput of coal with a limited increase in fuel consumption. But, whereas with steam, once the coke is cooled, flow can with advantage be up the walls of the retort to assist decomposition, with gas, the optimum effect on heat transmission through the charge will require, as is inferred, a more uniform distribution of the cross-section. Behaviour will depend more on the physical state of the charge, and further work proposed on the influence of both the size and the nature of the coal will yield most valuable results.

The evidence given in the paper indicates that when coal gas is re-cycled, degradation is not so extensive as might have been expected. This appears to be very important. In many circumstances it might be embarrassing if, for example, gas injection entailed the installation of complete gasification plant so that, in doubling the coal throughput in the retort house, the total gas output were increased more than threefold. In any case, the adoption of base-load gasification to the extent which the authors envisage would probably be best accomplished by having separate installations. This would be possible if the advantages of gas injection were obtained by re-cycling coal gas admixed with, say, producer gas, to control calorific value.

Finally, one can emphasise the importance of the flexibility in output which might be obtained through gas re-cycling. Demands for coke can fluctuate even more than those for gas, and, given the supplies of coal, exercising the ability to double both gas and coke output simultaneously at peak periods might easily be among the first applications of the 'Rochdale' process.—Yours faithfully,

F. J. DENT,

Director, Birmingham Research Station.

* * *

Sir,—The paper by T. Nicklin and M. Redman seems to have had rather a mixed reception, but it is quite clear that the authors have achieved one important result already —that is, to focus attention on the possibilities of an idea which was born many years ago and which has never been properly explored.

They have achieved a much higher throughput of coal in a continuous vertical retort, apparently with adequate devolatilisation of the coke and without trouble from high gas-offtake temperatures. Whether this can be combined with independent production of gas for circulation and dilution, either water gas or total gas, offers a field for economic study. I do not feel competent to discuss this aspect but I would like to make some observations on the technical side regarding the reasons for the new high level of coal throughput.

By the recirculation of producer gas or coal gas at 7,500 cu.ft. per hour the throughput of coal has been raised from 6.3 tons per retort per day to 14.3 tons at a sacrifice of gas yield of 23 therms. In terms of coal this represents an increase of 127%, and of gas output 68%. What is more remarkable is the fact that the limit of increase is not yet reached. The coal used was a Yorkshire washed double and one is inclined to think that, for such coal, the base line of the comparison (17% steam) has been set much too low for this size of retort. Despite this, however, the increases are still spectacular.

It would have been interesting to have struck a complete thermal balance in order to explain exactly what is happening, but this is not possible in the absence of temperature data for coke at discharge and gas at offtake, and consumption data for fuel gas. The effective heat requirement for the carbonisation of coal in the absence of steam is small, but the heat required to raise the coal to the temperature of carbonisation is about 12 therms per ton and it is this quantity which must be provided in the retort. When steaming, much of this heat is returned by the cooling of the coke to say 400°C. and serves for balancing the endothermicity of the formation of water gas. When circulating gas the same effect is observed of returning heat from the hot coke; the higher velocity of the gases must heat the downcoming coal more effectively, but the main flow of heat from the retort wall can hardly be affected. I would like to know whether the coke is cooled to a greater extent by circulating gas and whether the gases are cooled to the same extent before leaving the retort.

In comparing the two states we are therefore concerned with a system to which the inward flow of heat *per hour* is substantially unchanged but the heat requirement inside the retort is increased by 127%, *plus* twice the sensible heat loss in the gas, minus the heat of reaction of the steam. It is calculable that the heat absorbed in the water-gas reactions when steaming is about 2.5 therms per hour and the heat to be taken from the coke when circulating at double throughput is about 5 therms per hour. If the gas loss is 1.8 therms per hour when steaming it will be less (1.2 therms) when circulating, if the offtake temperature is the same. On a time basis, therefore, the position is that, at double throughput to simplify matters,

$$H_o + H = H_c + H_g - H_w$$

where H_o is the heat entering from the retort wall (4.0), H is the heat carried up from the coke (2.5), H_c the heat of carbonisation of the coal (4.0), H_g the thermal loss in the gas (1.8), and H_w the heat of the water gas reaction (2.5), all at normal throughput. If the known quantities are put into the equation it is evident that the extra throughput can be attained so far as thermal quantities are concerned. The remaining question is simply whether the rate of heat transfer to the circulating gas is high enough to effect the cooling of the coke and the rate of transfer from the hot gases to the coal in the upper part of the retort is high enough to effect complete transfer to the coal and give the same gas offtake temperatures. This, the experiments seem already to have demonstrated, but it is a fact that an increased rate of steaming will increase the gas offtake temperature very appreciably: why does it not do so with gas circulation? It seems difficult to believe that an increase of gas velocity to twice can increase the rate of heat transfer to this extent. It may be that one should consider only the relative volumes of water gas plus undecomposed steam on the one hand and circulated gas on the other. If so the relative volumes become 2:1 in favour of circulation; their effective temperature is also probably higher. If one examines the effects of steaming further, however, it is disquieting to find from Fuel Research data that the heat in the gases leaving the retorts is increased from 2.6 therms without steam to 6.5 therms per ton at 16% steam. These four therms could quite upset the above balance; what is the explanation?

This is an interesting piece of work and I hope that the authors will not be prevented by premature criticism of economics from making more complete observations on a more efficient plant and under more rigid control.—Yours faithfully,

J. G. KING,

21, The Lawns, S.E.3.

* * *

Sir,—A few days after the report of the 'Rochdale' process in the 'GAS JOURNAL' I applied the process in principle, but suitably modified, for the conditions in Lurgan. I can only at this stage describe the change that has been brought about as fantastic, and yielding results which previously were beyond the wildest dreams of a gas engineer, especially over here where facilities do not perhaps exist for the utmost exploitation of improvements.

The authors of the splendid paper have indeed done a job of work for the gas industry, and I have no doubt they will be suitably and amply rewarded. My personal thanks to Messrs. T. Nicklin and M. Redman and also at this stage an appreciation from many of my colleagues in the Irish gas industry who are going to benefit.—Yours faithfully,

J. W. YOUNG,

Engineer and Manager.

Lurgan Gas Department.

Britain's Best Young Cook

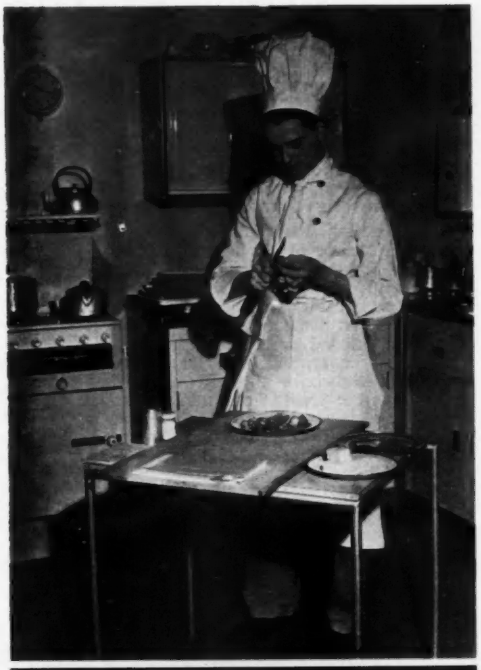
Patrick Green Wins Youth Competition Final

With enormous enthusiasm, impressiveness and polish the national final of the Youth in the Kitchen Cookery Competition at the Royal Festival Hall on April 6 set the seal on a large publicity project in which almost every undertaking in the country has played its part. From the original 25,000 entries the 12 survivors, all of them not more than 19 years old, stood up to a barrage of attention and publicity from which seasoned campaigners might well have flinched. Of these 12, Patrick Green, 18-year-old apprentice chef from Leicester, emerged victorious, followed by 16-year-old Shirley Strath, of Bexleyheath, 19-year-old Gwynneth Williams, of Llangwnadl, and 17-year-old Joan Comley, of Enfield. Apart from the winner, there was one other boy competitor.

The never-failing delight of the Festival Hall, the beautifully designed kitchens, and the opportunity to hear Andrew Fenner play the new organ all contributed to the pleasure of the event, which was attended by representatives of colleges, schools and youth organisations as well as by many young people. The latter in particular proved to the hilt the Gas Council's wisdom in selecting stars of youthful enterprise to present the prizes. They were Sheila Lerwill, world high jump champion; the cricketing twins, Alec and Eric Bedser; Tom Stacey, author and journalist, famed for his best seller *The Hostile Sun*; prima ballerina Violetta Elvin; Billy Knight, British and Australian junior lawn tennis champion; Yvonne Sugden, British Skating Champion; swimming champion, Lillian Preece, who captained the British Olympic team to Helsinki; Andree Melly, the young leading lady of 'The Moon is Blue' at the Vaudeville Theatre; Jean Aubrey, Hostess of T.V.'s Teenagers' Teleclub; W. R. Marsh, cox in this year's Oxford boat race crew and G. W. Tanburn, the Cambridge cox, and, finally, Britain's champion girl show jumper, Pat Smythe, who presented the first prize.

The Judges, all of whom contributed some extremely helpful comments at the prize-giving ceremony, were Mr. C. Bellfield-Smith, F.H.C.I., Past President, Hotel and Catering Institute, M. Jean Conil, founder of the Epicurean Society, Miss Phyllis Garbutt, A.R.I.C., Principal, Good Housekeeping Institute, Mrs. E. R. House, H.M. Senior Inspector of Housecraft, Ministry of Education, and Mrs. Hilda Whitlow, Cookery and Household Editor, *Homes and Gardens*.

At the conclusion of the afternoon's events Colonel Sir Harold Smith, Chairman of the Gas Council, paid a well-earned tribute to Dame Vera Laughton Mathews, who had played an important part in the organisation of the competition and, incidentally, whose name did not even appear in the programme.



In the top picture the winner is seen at work in his kitchen. The centre picture indicates intense concentration by the judges: Mrs. E. R. House (H.M. Senior Inspector of Housecraft), Mr. C. Belfield Smith (Past President, Hotel and Catering Institute), Miss Phyllis Garbutt (Principal, Good Housekeeping) and Mrs. Hilda Whitlow (Cookery and Household Editor, 'Homes and Gardens'). Below the 12 contestants demonstrate the confidence which was the wonder of all present.

South Western Reorganisation

The integration already achieved and the Board's future plans have made necessary an administrative reorganisation with effect from April 1, under which the functions of production and bulk transmission, and local distribution and consumer service will be separated.

The area has been divided into six divisions in place of the former Northern and Southern Divisions and eleven sub-divisions. The new divisions have been divided further into local administrative districts, the boundaries of which have been decided by consumer concentration or geographical considerations. Production and bulk transmission will be the responsibility of a separate engineering department, and the new divisions and districts will deal solely with consumer service and local distribution.

The following new appointments have been made:—

AREA HEADQUARTERS

General Manager, W. J. Baker, M.B.E.; Chief Engineer, L. P. Ingram, M.B.E. M.SC.; Development Manager, N. S. Smith; Deputy Chief Engineer, G. F. Oliver; Area Production Engineer, T. W. Clapham; Area Assistant Engineer (Devon and Cornwall), H. G. Stapley, Stationed at Torquay; Personnel Manager, K. E. Stringer; Coal, Coke, and Transport Manager, W. L. Wright; Publicity Assistant, F. Avery.

CONSUMER SERVICE

Cheltenham Division: Engineer and Manager, T. L. Tallentire; Distribution Engineer, A. G. Holtam; Commercial Assistant, M. R. Webb.

Swindon Division: Engineer and Manager, W. B. Claridge; Distribution Engineer, F. Tweedle; Commercial Assistant, W. S. Blunn.

Bristol and Bath Division: Engineer and Manager, T. N. Dent; Assistant Divisional Manager and Bristol District Manager, F. C. Gay, M.B.E.; Distribution Engineer, G. C. Gunston; Commercial Assistant, H. C. Wookey.

Weston-Super-Mare and Taunton Division: Engineer and Manager, T. W. Jackson; Distribution Engineer, O. Pincock, B.SC.; Commercial Assistant, H. Beacham.

Exeter, Torquay and Barnstaple Division: Engineer and Manager, J. W. Denton, G.M.; Distribution Engineer, F. W. Sansom, M.B.E.; Commercial Assistant, W. Freer.

Plymouth and Cornwall Division: Engineer and Manager, J. W. Dean; Distribution Engineer, A. R. Langford, M.B.E.; Commercial Assistant, E. G. Godwin.

ENGINEERING DEPARTMENT

Cheltenham Division, O. H. W. Boonham, Production Engineer.

Swindon Division, P. J. Whitehead, Production Engineer.

Bristol and Bath Division, C. R. Ingham, Production Engineer and Manager; D. W. G. Scott, Production Engineer.

Weston-super-Mare and Taunton Division, K. G. Bodiley, B.SC., Production Engineer.

Station Engineers: Evesham, J. W. Green; Lydney, J. Alcorn; Stroud, C. M. Smith; Cheltenham, E. L. Eggins; Bridgwater, P. Trevelyan; North Devon Group, S. B. Jones; Exeter, L. Baldwin; Torquay, D. J. Maunder; Exmouth, W. T. Baker; South Cornwall, W. Dougall.

DISTRICT OFFICERS

Evesham, W. N. Butlin, E. and M.; Cheltenham, J. D. Butler, E. and M.; Gloucester, W. A. Chard, E. and M.; Stroud, J. C. Cotterill, E. and M.; Forest of Dean, F. S. Pollicott, E. and M.; Swindon, A. B. Horsfield, E. and M.; Chippenham, E. V. Dunn, E. and M.; Bath, E. Annakin, E. and M.; Trowbridge, H. V. Pye, E. and M.; Weston-super-Mare, T. A. Nicholson, E. and M.; Wells, H. J. Bond, Manager; Yeovil, F. L. Whitehurst, E. and M.; Taunton, F. G. Craxford, Manager; Bridgwater, N. R. Taylor, E. and M.; Exeter, C. H. Gilbert, Manager; Torquay, J. E. Wilkes, E. and M.; Newton Abbot, W. Verity, E. and M.; Exmouth, H. W. Lock, E. and M.; Barnstaple, S. C. Huxham, E. and M.; Plymouth, A. Marshall, Manager; Truro, R. J. Williams, E. and M.; Penzance, N. C. Langford, Manager; Newquay, A. Holman Dunn, Manager; Bude, F. W. R. Santler, E. and M.

New Appointments in the East Midlands

The following new appointments are announced by the East Midlands Gas Board:—

DR. NORMAN WILLIAMS, Medical Officer in Charge, London Transport Executive, South West Division, has been appointed Senior Medical Officer to the Board as from April 1.

MR. J. H. BROOKE, Group Accountant, Wakefield Group, North Eastern Gas Board, has been appointed Assistant Divisional General Manager, Leicester and Northants. Division, as from April 1.

MR. F. G. PYPER, Divisional Engineer, Sheffield and Rotherham Division, East Midlands Gas Board, has been appointed Chief Engineer, Headquarters, with effect from May 1.

MR. C. E. MILLS, Assistant Divisional Engineer, Sheffield and Rotherham Division, has been appointed Acting Divisional Engineer, Sheffield and Rotherham Division, with effect from May 1, the appointment to be for a 12-months' period in the first instance.

MR. T. W. PHILLIPSON, Group Accountant, Burton-upon-Trent, was appointed Group Accountant, combined Derby/Burton Group, as from March 1.

Dr. Norman Williams, born in Yorkshire, studied medicine at St. Mary's Hospital Medical School, London. In 1942 he qualified as M.R.C.S. and L.R.C.P.; and became a house surgeon at St. Mary's Hospital until in the same year he joined the R.A.M.C. After serving in the Mediteranean Area for four years, he returned to St. Mary's Hospital as Supernumerary Medical Officer and remained there in 1946 and 1947, during which period he acquired the degrees of M.B. and B.S.(London). Dr. Williams then spent a year at the London School of Hygiene and Tropical Medicine, taking a Diploma in Public Health and also a Diploma in Industrial Health. From 1949 to 1954 he was with the London Transport Executive Medical Department, taking charge of the South West Division in 1951. In 1952 he published an original paper on 'Vanadium poisoning from cleaning oil-fired boilers.'

Mr. F. G. Pyper was educated at Haileybury College, and Jesus College, Cambridge, where he gained a Mechanical Sciences Tripos M.A. His other qualifications include M.I.MECH.E., M.INST.GAS E. and A.M.I.C.E. In 1925 Mr. Pyper joined the Gas Light and Coke Company, with whom he served at the Fulham, Stratford, and Beckton works as an Assistant Engineer, and 15 years later was appointed Assistant Chief Engineer with the Sheffield and District Gas Company. In 1949 he went to the East Midlands Gas Board as Divisional Engineer, Sheffield and Rotherham Division.

Mr. C. E. Mills joined the East Midlands Gas Board in 1951 as Assistant to the Divisional Engineer, Sheffield and Rotherham Division, and in September, 1953, was appointed Assistant Divisional Engineer. Mr. Mills, who holds the qualifications of M.INST.GAS E. and A.M.I.MECH.E., was engineering student with the Barrow Barnsley Main Collieries in 1931, and in 1939 moved to the Naval Ordnance Inspection Laboratories in Sheffield, where he remained until 1945. He was then appointed Engineering Assistant to the Rochdale gasworks, and five years later went to the Middleton gasworks as Acting Station Engineer, from where he joined the East Midlands Gas Board.

Mr. J. H. Brooke, a Yorkshireman, was before vesting date Secretary of the 16 companies associated with the West Riding Group of Gas Companies. After vesting date he was appointed Group Accountant of the Wakefield Group of the North Eastern Gas Board, where he remained until his appointment with the East Midlands Gas Board on April 1.

Mr. T. W. Phillipson is an Associate of the Institute of Municipal Treasurers and Accountants. From 1932 to 1937 he held several appointments with the Rural District Councils of Settle, Yorks; Repton, Derbys; and Tutbury, Staffordshire. Appointed Accountancy Assistant to the Treasurer's Department, Burton-upon-Trent County Borough Council, in 1937. Mr. Philipson left 11 years later to become Section Head, Accounting, Burton Sub-Area of the East Midlands Electricity Board, where he stayed for two years before becoming Group Accountant to the Burton Group of the East Midlands Gas Board.

PROGRESS . . .

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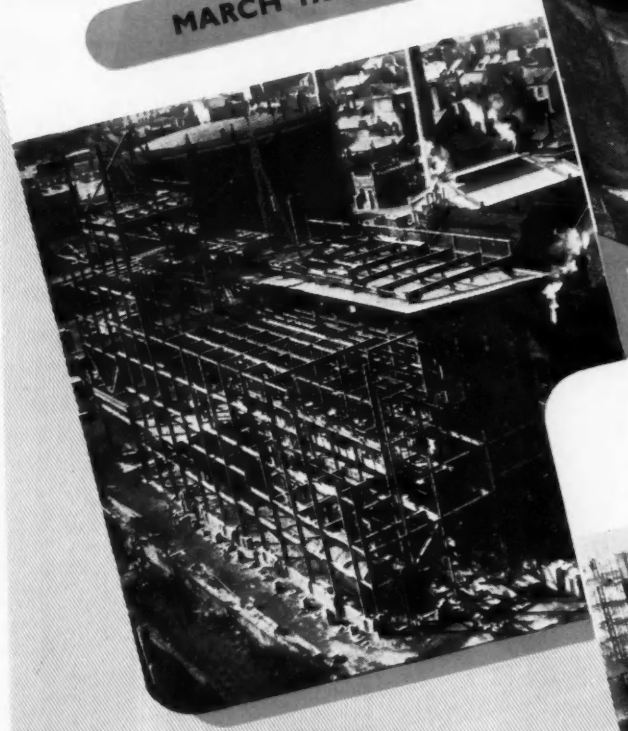

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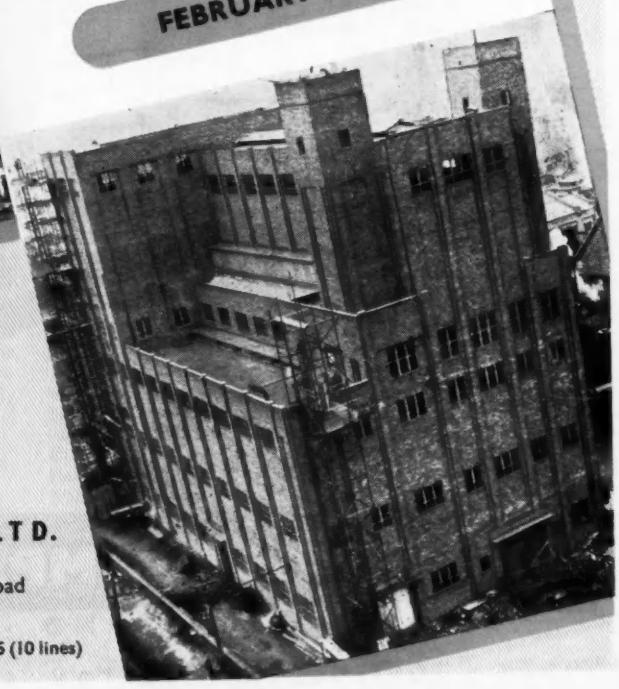

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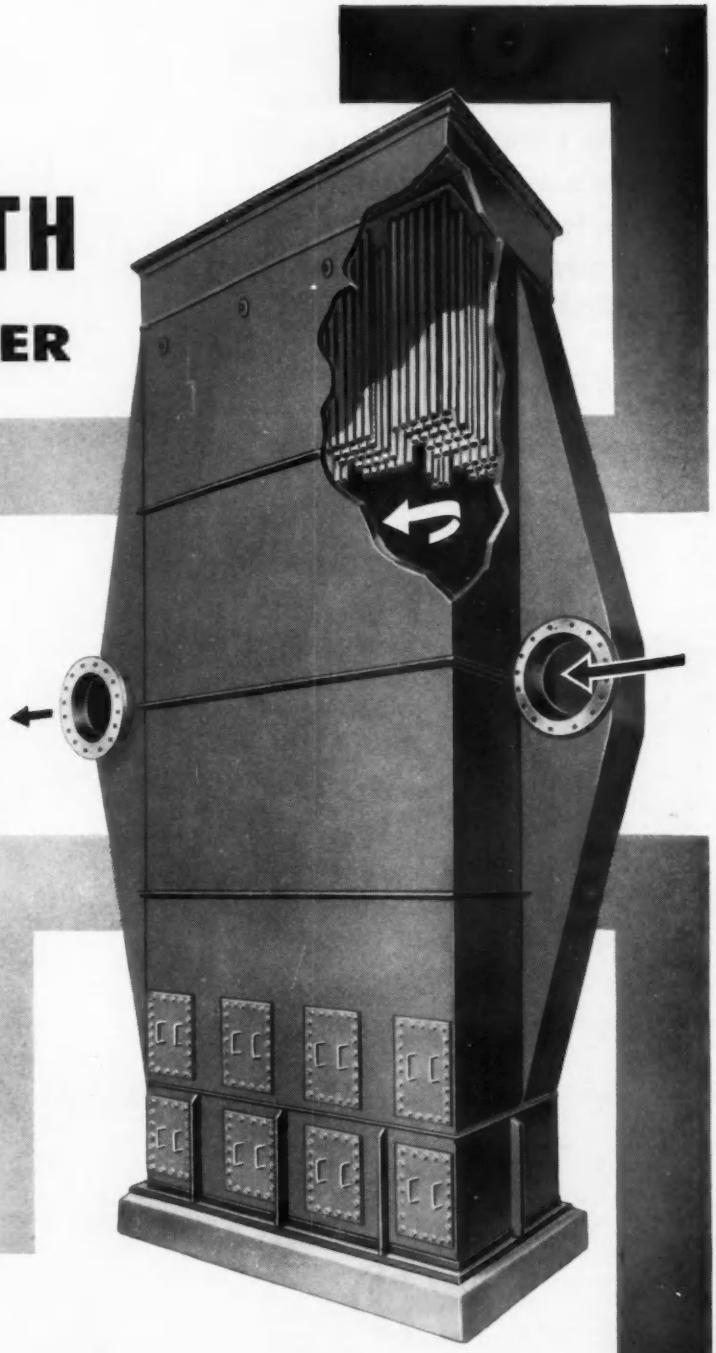

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COAL (MILLIONS OF TONS)

PROCESSING OF COAL

PAPER TO THE LONDON AND SOUTHERN JUNIOR GAS ASSOCIATION, ON APRIL 9, 1954, BY

M. S. GASKILL,

M.Inst.Gas E., M.Inst.F., F.C.S., Technical Director, West's Gas Improvement Co., Ltd.

A very considerable amount has been said and written of the advantages of the processing of coal as compared with its direct use as a fuel and the bearing which this has and could have on our national economy both directly and indirectly. While it would, of course, be impossible, for various practical and economic reasons, to process the whole of the coal mined in this country, there is little doubt that a greater proportion could be so dealt with to the national advantage.

In this connection it is of interest to note the distribution and development of the coal consumption in Great Britain. The main outlines of these two factors are shown in Fig. 1 covering the period from before the first world war until the present date and including an estimate of the possible trend up to 1965.

Table I gives the corresponding figures and percentages of the total consumption for the years 1913, 1938, and 1950 respectively. From these it will be seen that the proportion of coal processed as represented by the consumption figures for the main coal processing industries—*i.e.*, the gas and coking industries—is relatively small.

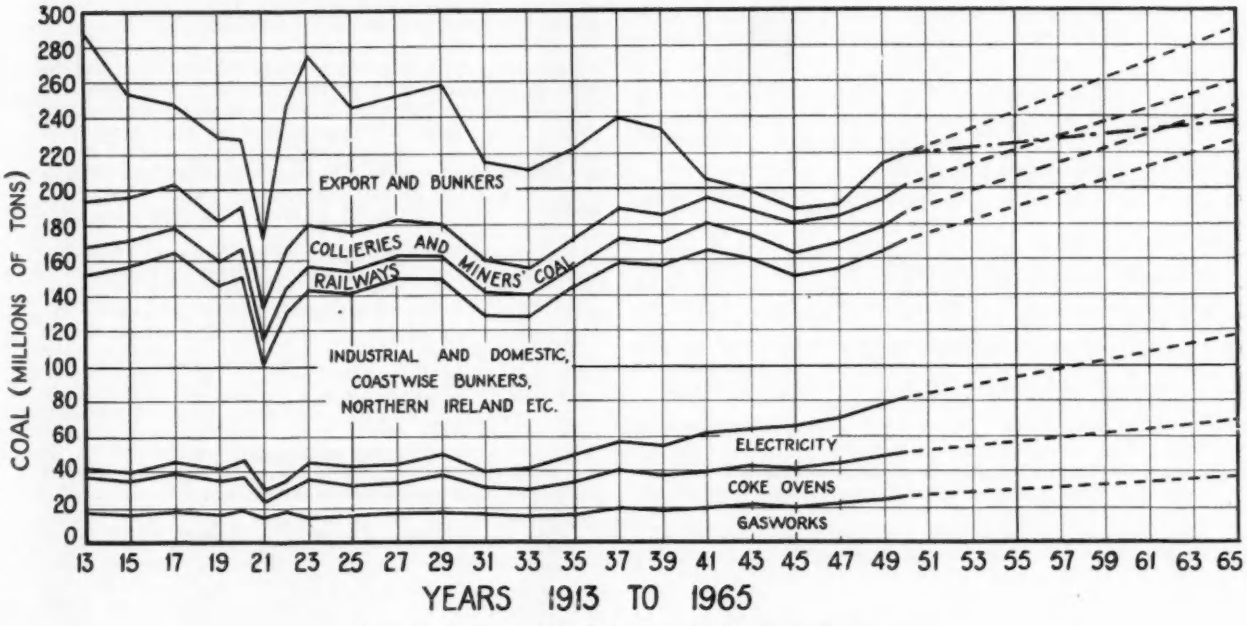


Fig. 1.—Analysis of Coal Consumption in Great Britain.

TABLE I.—COAL CONSUMPTION

	1913		1938		1950	
	Mill. tons	%	Mill. tons	%	Mill. tons	%
Gas industry	17.8	6.2	19.1	8.5	26.2	12.0
Coke ovens	19.7	6.8	19.1	8.5	22.6	10.3
Total processed	37.5	13.0	38.2	17.0	48.8	22.3
Electricity	4.9	1.7	14.9	6.6	33.0	15.1
Railways	14.3	5.0	13.2	5.9	14.5	6.6
Collieries	23.8	8.3	16.5	7.4	15.7	7.2
Industrial and domestic including coast bunkers and shipments to Northern Ireland ..	112.5	39.0	95.0	42.5	90.1	41.6
Overseas shipments and bunkers	94.4	33.0	46.3	20.6	17.7	7.8
TOTAL	287.4	100.0	224.1	100.0	219.2	100.0

It is difficult to determine exactly when the processing of coal, as distinct from using it in its raw state as a fuel, was first practised and by whom the idea of processing was first evolved.

In 1620, in the reign of James I, a patent was granted to Hugh Grundie by which he was granted 'the sole right for 21 years to charke coal, being an invention never heretofore put in use or brought to perfection until the same was donne by the said Hugh Grundie.' He was also granted the sole right to use the fuel so obtained for casting and refining iron. Even in those early days atmospheric polution appears to have received some attention, for in 1636 Thomas Peyton, of Deptford, patented 'a perfect way of charking seacoles for that they burn without smoke or other annoyance and very good for chamber fires.'

No details are available of these patents but it is probable that the means adopted followed closely the usual practice for charcoal burning; and it was from this method of coke manufacture that the beehive coke oven was developed. In these ovens the whole of the gaseous products were lost, the sole object being the manufacture of coke, mainly for metallurgical processes. Although Robert Boyle in 1691 recorded the evolution of combustible gas from coal, and in 1739 the Rev. J. Clayton obtained gas by heating coal in a closed vessel, it was not until 1792 that Murdoch made practical use of gas from coal.

Coal Processing

From this period until comparatively recent times there were therefore two main systems of coal processing—*viz:*—

(1) 'Coking,' in which the coke was the desired product and the gas produced in excess of that required as

fuel in the process was regarded as a waste product and was in fact in many cases burnt to waste. The forerunner of the modern coke oven was invented by José Luis in 1858, although in this system the charge was still partially carbonised by internal combustion, the first horizontal coke oven to be completely externally heated being developed by Pernolet in 1862. While the first by-product oven was built in this country in 1882, in 1921 out of a total of 13,000 coke ovens in operation over 4,000 were of the beehive type. Even as recently as 1951 there were still 246 beehive ovens in use. The figures for the disposal of the coke oven gas made during this year (1951) are of interest.

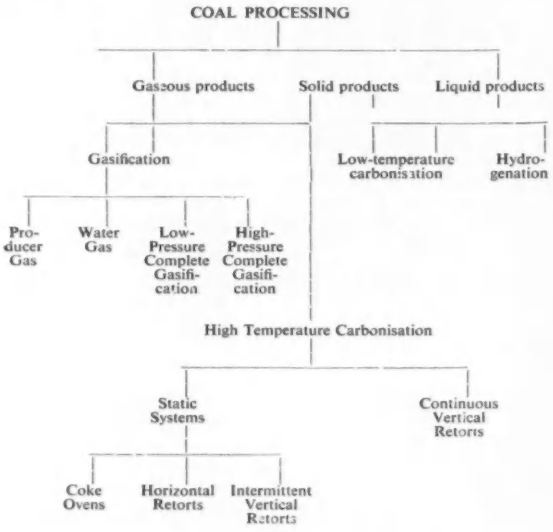


Fig. 2.

Out of a total gas production of 254,214 mill. cu.ft., 112,898 mill. cu.ft. (49%) was used in the coke ovens for heating the ovens, steam generation, etc. The gas industry absorbed 66,401 mill. cu.ft. (26%), 69,587 mill. (28%) was used for other purposes, mainly in the steel used for other purposes, mainly in the steel industry, and 5,328 mill. cu.ft. (2%) was bled, burnt to waste, or otherwise lost.

(2) 'Gas-making,' in which gas was the main product, and coke was considered at least in the earlier development of the gas industry as an unavoidable and not particularly desirable by-product. This attitude may be perhaps illustrated by the fact that in certain parts of the north of England coke was frequently described as 'gas-works cinders.' It might even be suggested that this attitude had persisted in some spheres, since it is only comparatively recently that the importance of coke preparation and marketing has received the attention which it merits and, indeed, demands.

While some methods of coal processing can be classified according to the main products, from the foregoing it will be seen that the chief coal processing industries—*i.e.*, coking and gas-making—do not lend themselves to close classification, since each of these industries is, through force of circumstances, a considerable producer of very substantial quantities of the alternative fuel.

This proviso must therefore be kept in mind when considering Fig. 2, in which an attempt has been made to evolve a basis or starting-point for a further study of the various methods of coal processing. The scheme of classification shown in the figure provides an approximate outline for this purpose, but it must, of course, be recognised that it is by no means complete and in several respects open to criticism.

This chart does, however, show that the processing of coal can more logically be divided, not into the two aspects covered respectively by the gas manufacturing and coking industries, but into three main categories—*i.e.*, gasification, high-temperature carbonisation, low-temperature carbonisation.

It would be quite impossible within the scope of this paper to attempt even a brief summary of even the various basic methods of coal processing indicated in Fig. 2. I therefore propose to limit my remarks to the systems shown under the heading of 'High-Temperature Carbonisation' with only a very brief reference to the other systems of coal processing.

Producer Gas

While in the gas industry producer gas is rarely made from coal, it is estimated that some 6 mill. tons of coal is gasified per year in producers in this country. When coal is used as fuel in producers it is advisable to select non-coking coals of low swelling index. Difficulties may be experienced due to the nature of the tar in the gas. If, however, the gas leaves the producer at a high temperature and is maintained in this condition up to the point of combustion, little trouble should be experienced and the thermal value of the tar will be obtained as fuel. Fig. 3 shows a type of mechanical producer which has been developed with this object in view. This has been fully described elsewhere.

A typical percentage analysis of producer gas made in a mechanical producer using coal would be as follows:

CO_2	4.0
CnHm	0.5
CO	28.0
CH_4	2.5
H_2	13.0
N_2	52.0
Sp. G. (air = 1)	0.87
Calorific value B.Th.U. per cu. ft.	165

As far as I am aware, in this country, coal has not been gasified in water gas plant except experimentally. It has however been practised successfully in the United States and more recently in South Africa.

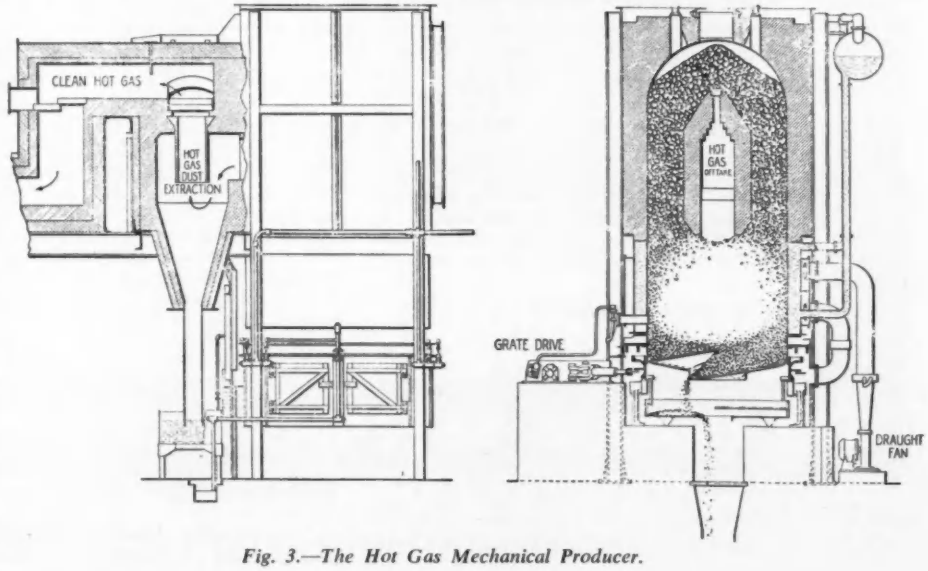


Fig. 3.—The Hot Gas Mechanical Producer.

Complete Gasification

A number of plants have been installed in this country for low-pressure gasification, fundamentally by a development of water-gas manufacture. So far no commercial high-pressure complete gasification plants have been operated in Great Britain. Recently considerable attention has been focused on these methods of processing coal, and the outcome of the various projects either in hand or under consideration is awaited with interest.

While complete gasification may play an important part in the national fuel economy it is very doubtful if it could replace to any extent the normal methods of gas manufacture practised by the gas industry, since it is considered that for many years to come the gas industry must remain a two-fuel industry. For domestic purposes coke and other smokeless fuel should, and probably will, replace raw coal. The seasonable, and, due to the vagaries of our climate, rapidly varying domestic heating demand at present met by storable solid fuel could not be economically dealt with by either the gas or electricity industries at the present time, or indeed in the reasonably foreseeable future.

Low-Temperature Carbonisation

On the subject of low-temperature carbonisation it may be said without undue exaggeration that the methods proposed and tried have been 'legion.' Of this legion few have resulted in successful commercial processes. Recently the possibility of the development of low-temperature methods for the manufacture of coke, more particularly coke suitable for metallurgical uses, from non-coking coals has received attention.

A report on this subject has been published by the Organisation for European Economic Co-operation. In view of the growing shortage of coking coal, not only in this country but in Western Europe, this development is of definite importance.

The hydrogenation process has been employed only to a limited extent in Great Britain. It consists in treating pulverised coal, sometimes mixed with oil, at pressures of 200 to 300 atm. and temperatures of 300° to 450°C. This results in the formation of oils and spirits, together with some permanent gases and a solid or semi-solid residue. The process should form a valuable adjunct for providing the means of carburetting the somewhat low calorific gas obtained from high-pressure complete gasification.

Gas Industry Methods

We now come to what may be termed the normal gas industry methods or systems. In this paper I propose to review these methods not from the usual standpoint but from the angle of coal processing. In this connection and for the purpose in mind it is necessary to consider the meaning of the word 'processing.' One of the definitions of the word is the carrying out of operations to obtain a desired result.'

At this point it is suggested that we should consider the extent to which the operations which occur in the carbonising unit are carried out, or merely happen.

Basically all the processes included in Fig. 2 under high-temperature carbonisation involve the introduction of coal into a closed vessel and the application of heat. But having done this the question arises as to what extent in any given system the effects of this application of heat upon the coal can be controlled to give predetermined products or results.

To study this question it is obviously necessary to consider the effect of heat on coal. To this subject an immense amount of research has been devoted and widely varying opinions and theories have been advanced. In the following section of the paper the subject is, of necessity, dealt with only in the briefest outline. Much that is included may be controversial; but even if it merely serves to direct attention to a most interesting subject, it will, I trust, fulfil a useful purpose.

The Pyrolysis of Coal

Sir Charles Ellis, in his recent paper to the Institution of Gas Engineers, suggested that the results of heating coal can be divided into four zones or regions.

1. Pre-decomposition up to about 300°C.
2. Decomposition 300° to 550°C.
3. Transformation (semi-coke to coke) 550° to 1,000°C.
4. Structure in coke 1,000° to 3,000°C.

This classification forms a very useful basis for a necessarily brief consideration of the possible reactions during that form of coal processing which is termed carbonisation. It is not, of course, suggested that these zones are distinct, or unrelated. The temperatures given are only approximate. There is little doubt that the treatment of the coal during the pre-decomposition range has considerable influence on its behaviour in the decomposition range, and similarly that conditions obtaining during this second zone affect the transformation of semi-coke to coke. As far as I am aware no definitions of coke and semi-coke have ever been established. Much of the material known generally in the gas industry as 'coke' is in all probability formed at temperatures not exceeding 900°C. It is considered that in the case of an appreciable amount of the coke made in many types of normal carbonising plant the main gas evolution and the coke-forming period are completed at temperatures not exceeding 900°C.

The material or, perhaps more correctly, materials which are known under the general term 'coal' is of an extremely complex structure. The mechanism and results of the break-down of this structure are even more complicated. There is therefore considerable risk in attempting to produce a more or less simple pattern or scheme even in general terms to explain the behaviour of coal during carbonisation. This must be borne in mind when considering the following suggestions.

Two main physical reactions take place when coal is heated:—

(a) Decomposition.
(b) Plasticity.

Decomposition

Decomposition takes place over a temperature range of 280°C. to 400°C. dependent on the coal. It has been suggested by Roberts and Jenkins that the 'active decomposition point'—*i.e.*, that temperature or temperature range at which a marked rise in the rate of gas evolution occurred—is directly related to the carbon content of the pure coal substance.

The products of this primary decomposition are mainly hydrocarbons of the cyclohexane and cyclohexene types which are unstable under the conditions normally obtaining in a retort. The secondary decomposition is probably a most complicated process including an almost unlimited number of reactions involving polymerisation, condensation, hydrogenation and dehydrogenation. This secondary decomposition takes place at temperatures of 500°C. and over and results in unsaturated hydrocarbons of high calorific value together with ethane and methane. If the gaseous and liquid products of this secondary decomposition are subjected to higher temperatures, further decomposition takes place with the formation of the higher aromatic compounds and eventually of carbon and hydrogen.

Plasticity

It has been shown that the heating of most if not all bituminous coals under suitable conditions will give rise to plastic, viscous, or elastic flow or possibly combinations of these types of flow. It has been suggested that coking of bituminous coals is caused by the filling of interspaces and coalescence of the particles by surface tension effects resulting from plastic flow.

The temperature range over which plasticity takes place varies with different coals. It may start as low as 370°C. and extend to temperatures approaching 600°C. It will therefore be seen that gas evolution and plasticity are occurring simultaneously. The plasticity range is also affected by the rate of heating of the coal since rapid heating substantially reduces the extent of the range.

The effect of rate of heating and a relationship between plasticity and gas evolution are shown in Table 2 based on the work of W. Davidson.

TABLE 2.

Coal	Rate of Heating deg./min.	Plastic Range °C Start	End	Range	Total %	Organic Volatile Content Evolved Before during Plasticity	after Plasticity	Content Plasticity
Scottish ..	1	400	480	80		1.3	14.4	18.2
	3	400	516	116	33.9	1.3	17.1	15.5
	5	400	535	135		1.3	18.0	14.6
Durham ..	1	361	508	147		0.2	14.9	12.3
	3	361	548	187	27.4	0.2	15.9	11.3
	5	361	564	203		0.2	15.8	11.4
Yorkshire ..	1	376	495	119		1.4	16.7	14.9
	3	376	532	156	33.0	1.4	16.7	14.9
	5	376	549	173		1.4	18.4	13.2
Derbyshire ..	3	430	460	30	35.8	3.9	6.7	25.4
	5	430	485	55		3.9	7.2	24.7

A considerable amount of research has been carried out on the subject of plasticity and numerous methods have been evolved for its determination. It has an important bearing on the evaluation of coal for use in coke ovens since it has been shown that a relationship exists between plasticity and expansion and the latter affects not only the coke quality but the limits of safe pressure on the oven walls. This relationship is shown in the following data extracted from a Bulletin of the U.S. Bureau of Mines:—

Coal	Temperature of Maximum Plasticity	Expansion at Bulk Density of 55.5 lb. per cu. ft.
1	479°C.	+27.8%
2	476°C.	+19.9%
3	461°C.	+16.8%
4	429°C.	− 7.6%
5	426°C.	− 9.3%

While expansion during carbonisation does have a considerable influence on the operation of the normal types of gasworks carbonising system it is considered that in such cases the main influence of plasticity is its effect on the passage of the gas through the charge.

During the passage of heat from the retort walls to the centre of the charge a plastic layer is formed, and this layer offers resistance to the passage of gas. In fact, in certain circumstances, it may be practically impermeable. Since, as has been shown, the temperature at which plasticity occurs lies within the temperature range of gas evolution a considerable proportion of the gas must be evolved on the outer or hot side of the plastic layer.

Experiments carried out by Sapogknikov (Coal Carbonisation, 1947) have shown that with plastic layer thicknesses of 5, 10, 15, 20, 25, 30, and 35 mm. the corresponding gas volume yields on the cold side of the layer were 70, 35, 22, 16, 12, 10, and 9% respectively.

It is, of course, well known that a considerable proportion of the gas does pass through the hot coke and ultimately comes in contact with the heated wall of the carbonising chamber and that the final product is therefore a resultant of the more or less unknown and normally uncontrollable heat treatment which the gas thus receives. It is therefore of interest, in view of the foregoing, to examine the various systems of carbonisation to determine if it a practical possibility to effect any control on the factors involved.

Control of Coal Processing

The selection, preparation, and pre-treatment of coal can, of course, have a considerable influence on the results of carbonisation. Unfortunately these are factors which usually receive little attention in the gas industry and are at the present time to a great extent outside its control. In the case of static systems of carbonisation it is suggested that, once the coal is introduced into the retort or chamber, very little measure of control is possible. It would therefore appear that the continuous vertical retort offers the greatest possibilities in this connection.

Since I might be accused of some bias in making this statement I might at this point quote, although somewhat out of its context, from Dr. Pexton's paper 'Fuel Requirement of Carbonisation Plant' wherein he stated that 'this system (*i.e.*, continuous vertical retorts) offers the greatest scope for further improvements.'

Since in a paper of limited length it is impossible to follow-up the many interesting lines which arise from the foregoing statements, I propose to limit the remainder of this paper to a somewhat brief description of one aspect of carbonisation control in continuous vertical retorts which has recently been investigated.

Internal Heating

Some of the results of the normal method of heating coal—*i.e.*, by the passage of heat from the retort wall through the charge, have been outlined. If, however, the coal could be more evenly heated by bringing the heating medium into intimate contact with the coal, as could be effected by the passage of a hot gas through the charge, it would appear that a new set of conditions with interesting results would arise due to the possible modification of the plastic state. For this purpose the continuous vertical retort is eminently suitable, since the lower portion of the retort contains hot coke suitable for heating the gaseous medium. This process, of course, already occurs to some extent during steaming.

The proposal is not new; in fact, I believe the passing of gas into horizontal retorts was practised as long ago as 1860. During the development by the late Mr. John West of the process of steaming continuous vertical retorts he proposed as an alternative to steam that 'stripped' coal gas, blue water gas, or producer gas could be passed up the retorts. A patent covering this invention was taken out by West and Perkin in 1917 and the process was described in a paper given to the Southern Association of Gas Engineers and Managers in that year. In 1930 Messrs. Bamber and Smith carried out a further investigation with very interesting results at Bolton. At the time of the original patent, and for many years, the process was for economic and other reasons less advantageous than steaming. During recent years the economics of the gas industry have changed rapidly; and apart from the technical possibilities and potential developments of internal heating it was of considerable interest to investigate the process to assess its economic value under present-day conditions.

It was therefore decided to carry out an extensive programme of research on this subject. An investigation on somewhat similar lines has recently been reported by Messrs. Nicklin and Redman and the results have been given in a paper 'Accelerated Continuous Carbonisation' presented to the Manchester and District Section of the Institution of Gas Engineers (see 'GAS JOURNAL' of March 17).

While a considerable amount of research extended over a period of years has been done with reference to the results and conclusions submitted in this paper, it is emphasised that no claim is made to have reached finality. This is particularly true in relation to their economic aspects, and it is considered that the application of the process in any particular set of circumstances must be studied carefully with relation to each case.

The theoretical considerations of the possible effect of internal heating have already been outlined. Before proceeding to the details of the results obtained during the investigations it is of interest to consider a brief and simple statement of the basic considerations of the application of the process to continuous vertical retorts of existing designs. It will be obvious that development of the process might materially affect design of future installations. This, however, is another field and one which it is not proposed to enter on in this paper.

To make gas from coal it is necessary to heat the coal to a temperature at which decomposition takes place. This temperature is dependent on the type of coal but usually is not more than 600°C.

The actual 'breaking down' (the carbonisating process proper) absorbs little or no heat—*i.e.*, the reactions which take place during the evolution of gas and formation of coke are substantially thermally neutral. In fact, it has been proved that with certain coals the reaction is exothermic—*i.e.*, some heat is evolved.

In the normal operation of carbonising coal in continuous vertical retorts the heat necessary for the process is conducted from the combustion chambers surrounding the retort, through the retort walls, and through successive layers of coke and coal in the retort until the centre of the charge is reached. Conductivity through

these layers is low, and, in order to obtain the required, and *comparatively low*, temperature in the centre of the charge, the outer layers of coke must be heated to a high temperature. As a result, at the completion of the carbonisation process, most of the resulting coke has attained a temperature of probably 1,000°C.

Steaming

Steaming in continuous vertical retorts may be considered as two successive operations. First, the raising of the temperature of the steam within the retort to that necessary for the water gas reaction; and, secondly, the reaction itself.

To carry out these operations, a certain amount of coke, dependent on the extent of steaming desired, which has reached a suitable condition in the process, is essential. The amount or volume of coke represents a definite proportion of the retort volume and thereby limits the proportion to the retort available for carbonisation, so that the throughput of coal is approximately in inverse proportion to the amount of water gas production required.

While a considerable amount of heat is taken up by the endothermic water gas reaction, the water gas formed in the retort and the unconverted steam carry a certain amount of heat from the coke to the coal in the upper portion of the retort, thus contributing to the high thermal efficiency of the continuous vertical retort system.

The 'Carrier' Gas

It would appear, however, that, if a gas which did not enter into any reaction in the retort could be used as the medium for heat transference from the coke at the base of the retort to the coal at the top of the retort, certain advantages would result. This possibility formed the basis for the investigation.

The advantages which were foreseen can be briefly summarised as follows:—

The maximum amount of heat within the retort would be available for transfer and the proportion of the retort available for carbonisation would be increased. A substantial increase in coal carbonised per unit should be realised.

The increased thermal output and coke production per unit of plant would reduce the capital cost per therm of gas produced.

The flexibility of gas manufacture would be increased, since either steam, water gas, producer gas, or other gases could be utilised as carrier gases. The fuel consumption per ton of coal carbonised would be reduced. Against this would be placed the fuel for producer gas, or water gas or other 'carrier' gas generation, less the fuel value of the steam which would be used in the normal steaming process.

Increased gaseous thermal yield and tar production per ton of coal due to altered carbonising condtions and in the case of the gaseous thermal yield to the reduction of carbon dioxide in water gas or producer gas to carbon monoxide.

Ability to maintain or even somewhat increase the nominal output of carbonising plant when using small and/or inferior types of coal.

Improvement in the quality of the coke by elimination of degradation and surface ash deposits from normal practice of steaming, with possible increase in reactivity.

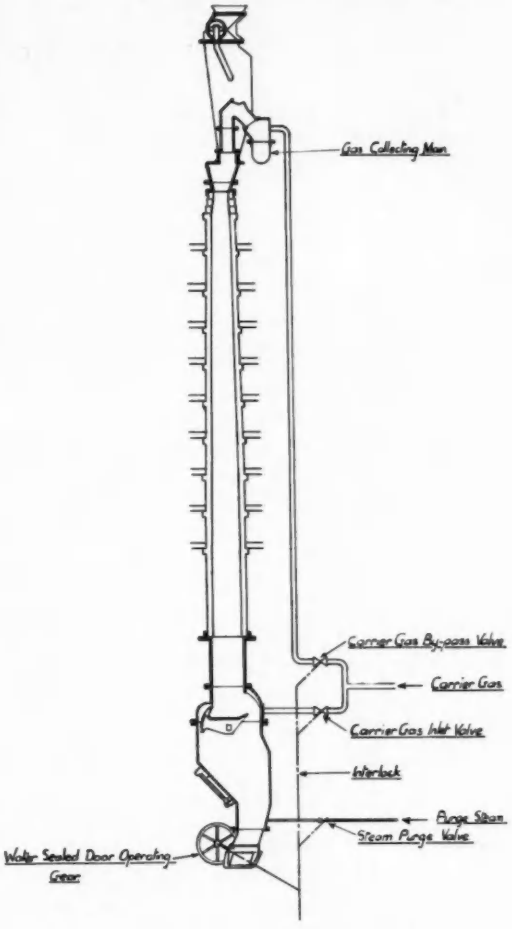
A further development of this method of operation is the ability to maintain the normal or rated throughput of the retorts with considerably reduced combustion chamber temperatures. While this procedure would in most cases be not so attractive as the alternative previously outlined, it would result in low fuel consumption and long retort life. Under these conditions, it might prove possible to admit coal gas, the use of which is precluded from high-temperature work on account of the degradation which would take place.

In the present series of tests no attempt was made to operate with low combustion chamber temperatures, though experiments made some years ago with another object in view have indicated possibilities in this direction.

Description of Test Plant

The investigations were carried out on one 50-in. Glover-West continuous vertical retort with sector discharger installed on the Research Plant of West's Gas Improvement Company. Producer gas was provided by a small pressurised step-grate producer. A suitable Humphreys and Glasgow water gas plant with automatic operation was installed to provide the required supply of blue water gas. The whole plant is furnished with all necessary equipment for weighing, measuring, and testing.

This retort is of standard design with top mouthpiece, gas offtake, and collecting main all of the usual type and dimensions. The only departure from well-known standard practice was the coke discharge door which was of a



Description of Valve	Position of Valve during Gas Admission	Position of Valve during Coke Discharge
Carrier Gas Inlet Valve	Open	Closed
Carrier Gas By-pass Valve	Closed	Open
Steam Purge Valve	Closed	Open

Fig. 4.—Diagram showing application of gas admission to test retort.

recently-developed water sealed type. The retort was operated in the normal manner except that at high throughputs it was necessary to discharge the coke at more frequent intervals.

Prior to coke discharge the bottom mouthpiece and coke chamber were purged with steam. The sequence of the discharging operation was as follows:—Purge steam on and 'carrier' gas off, door opened, coke discharged, door closed, 'carrier' gas on, and purge steam off.

For obvious reasons care was taken to maintain all bottom ironwork, supply pipes, and valves in a gas-tight condition.

Since only one retort was in use, some difficulty might have been experienced with governing when the 'carrier' gas, which in some tests represented a considerable proportion of the total volume leaving the retort, was shut off. This was overcome by providing a bypass by which during the short discharge periods the 'carrier' gas can pass direct to the collecting main. This arrangement would not be necessary in the case when a number of retorts were being operated.

Fig. 4 is a diagrammatic arrangement of the layout showing the points of 'carrier' gas admission and bypass; also of the steam purge and interlock.

The retort heating was of the standard type for a single unit setting. Throughout the tests temperatures were maintained constant. The average combustion chamber temperature was approximately 1,300°C.

Scope of Investigation

In the original conception of this method it was proposed that coal gas, water gas, or producer gas should be used. It was known from the work of Bamber and Smith, and from previous preliminary investigations, that appreciable increases in coal throughput could be obtained.

The investigation was therefore directed to the examination of the practical application of the process, the determination of the best type of 'carrier' gas, the effect of the method on the carbonising process, and the results with various types of coal. These results were to include not only gaseous thermal yields but the quantity and quality of the tar and the screen analysis and properties of the coke made.

The 'carrier' gases so far employed have been producer gas, water gas, coal gas, and mixtures of coal gas and water gas. The coals carbonised have been sized Yorkshire, Scottish, and Welsh coal, and Yorkshire and Durham slacks.

It will be appreciated that in this process the larger the volume of 'carrier' gas admitted the greater the increase in throughput within, of course, limits imposed by the amount of useful heat available for transfer from the coke to the coal.

When using a 'carrier' gas of low calorific value such as producer gas or water gas the results obtained are therefore the reverse of those resulting from the steaming process. When steaming, as the calorific value of the gas made is reduced, with any given coal, so the throughput of coal per retort becomes correspondingly less. With gas admission, increasing the volume of the carrier gas increases the throughput, but at the same time the use of producer gas or water gas results in an output of gas of lower calorific value.

The process would therefore appear to yield the best returns when making gas in the lower calorific value ranges. The use of a carrier gas of higher calorific value such as coal gas or a mixture of coal gas and water gas gives a high coal throughput while preserving a final gas of high calorific value. Such a procedure has, however, the disadvantage of thermal loss due to degradation of the carrier gas.

Most of the test periods in the investigations here reported were therefore carried out when making a final gas of 450 B.Th.U. per cu.ft. With each coal comparative tests were made at this calorific value with steaming and with gas admission.

General Observations

With the application of the appropriate precautions and technical control no difficulty was experienced in the operation of the process. In fact, regularity and ease of the passage of the coal through the retort was improved. It is, however, essential to maintain a constant admission of 'carrier' gas. Any interruption of the supply even for a comparatively short period rapidly resulted in the extraction of uncarbonised material.

Summary of Results

As already stated, the results to date are considered merely as having reached an interim stage in the development. There are still a considerable number of interesting points to be investigated in the results, technique, and potentialities of this system. The following is a brief summary of these results; further details are given in Tables 3 to 13.

With Yorkshire coal, using producer gas as the 'carrier' gas, an increase in throughput of 125% and in thermal output per retort of 54% was obtained when making gas of approximately 450 B.Th.U. per cu.ft. as compared with steaming under similar conditions. The thermal yield per ton of coal was, of course, reduced, and the inert content of the resulting gas was high.

In the case of the Scottish and Welsh coals, and a later test on another type of Yorkshire coal, blue water gas was used as the carrier. With the Scottish coal the increase in throughput *and* thermal yield were 112% and 113% respectively, while the Welsh coal gave increases of 91% and 88%. The thermal outputs given in each case include the 'carrier' gas.

When coal gas and mixtures of coal gas and water gas were utilised, while similar increases in throughput were obtained, appreciable degradation of the 'carrier' gas occurred, with resulting loss in thermal yield.

In regard to the carbonisation of small coal, two series of tests have been made—one series with Durham slack and one with Yorkshire slack. The 'carrier' gas was producer gas in both cases.

The Yorkshire slack contained approximately 73% below ¼ in. and 27% below ⅛ in. With this coal, when making gas of 450 B.Th.U., an increase in throughput of of 64% was achieved as compared with steaming to approximately the same calorific value. With the Durham slack, of which the screen analysis was 82% below ¼ in. and 27% below ⅛ in., an increase of 63% in throughput resulted.

These latter results indicate the possibilities of the application of the process to the carbonisation of low-grade coals. The yield of tar per ton of coal is considerably increased. A typical analysis is given in Table 10.

There is some indication that the yield of tar and its composition are functions of the rate of 'carrier' gas input relative to coal throughput. In fact the relationship between the volume of carrier gas and the coal throughput has a definite effect on several aspects of the process. There is little apparent effect on the bulk density, strength, or reactivity of the coke. It would appear, however, that some variation in the coke structure takes place. The screen analysis of the cokes made indicate that, while the

TABLE 3.—PRODUCER GAS ADMISSION

Test Description	General Results A Steaming	B Producer Gas	C Steaming	D Producer Gas	E Steaming	F Producer Gas
Coal	Yorkshire	Yorkshire	Yorkshire Slack	Yorkshire Slack	Durham Slack	Durham Slack
Coal/retort 24 hr./tons	4.0	9.04	3.96	6.5	3.9	6.37
Average C.V. of gas B.Th.U./cu. ft.	455	456	477	481	450	454
Gas output per retort/24 hr., cu. ft.	95,150	144,800	85,160	89,170	87,000	113.500
Gas per ton of coal, cu. ft.	23,800	16,021	17,210	13,720	22,500	17,800
Therms per ton of coal	108	73.1	82.1	66	101	80.9
Therms/retort/day	430	661	325	429	394	516
Gas admitted/hour, cu. ft.	—	2,400	—	1,790	—	1,370
cu. ft./ton of coal	—	6,400	—	6,600	—	5,150

TABLE 4.—WATER GAS ADMISSION

Test Description	General Results G Steaming	H Water Gas	I Steaming	J Water Gas	K Steaming	L Water Gas
Coal	Scottish	Scottish	Welsh	Welsh	Yorkshire	Yorkshire
Coal/retort 24 hr./tons	4.78	10.55	4.32	8.25	5.05	10.97
Average C.V. of gas, B.Th.U./cu. ft.	440	440	452	457	462	460
Gas output/retort 24 hr./cu. ft.	92,730	220,120	95,370	179,900	89,140	187,800
Gas per ton of coal, cu. ft.	19,400	20,870	22,070	21,810	17,642	17,117
Therms per ton of coal	85.4	91.8	99.8	99.7	81.6	78.8
Therms/retort day	408	969	431	822	412	864
Gas admitted per hr., cu. ft.	—	5,000	—	3,500	—	4,000
cu. ft./ton of coal	—	11,300	—	10,400	—	8,790

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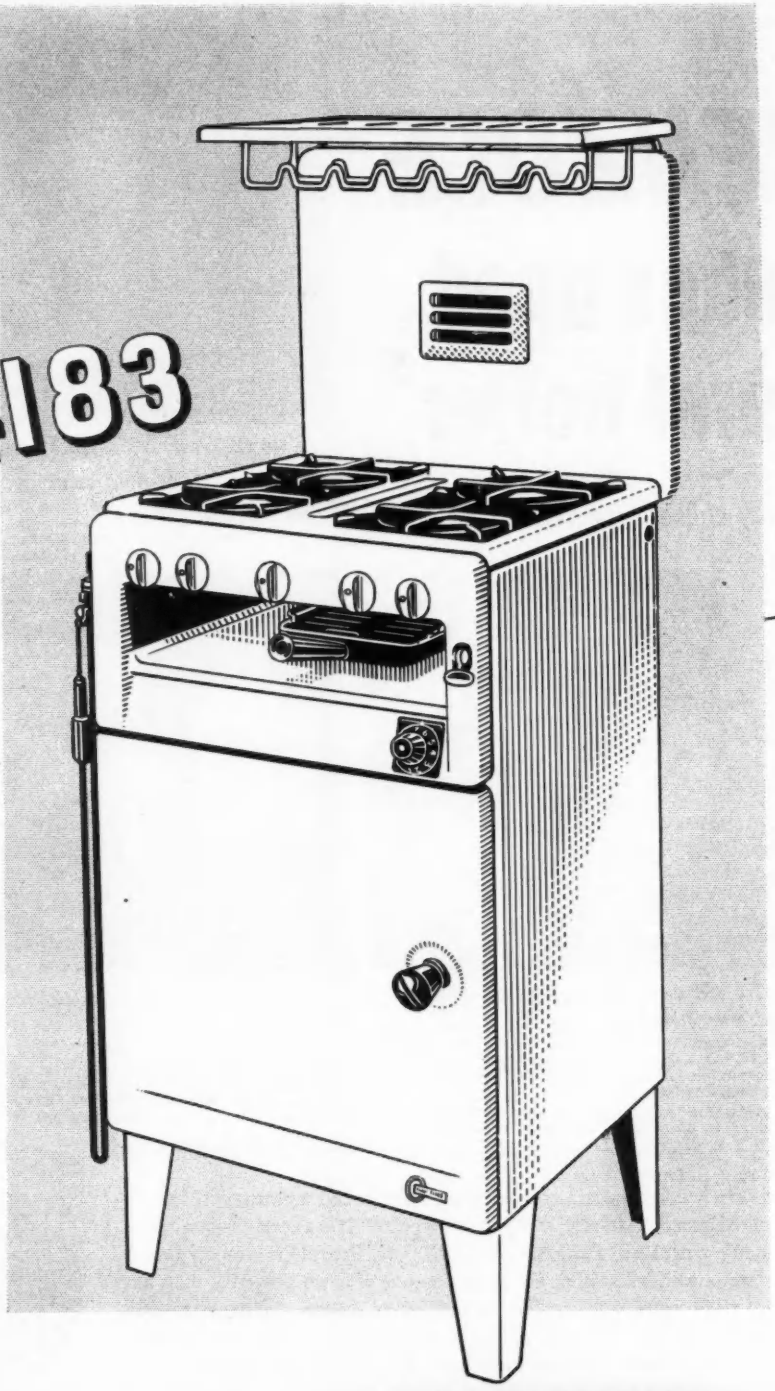

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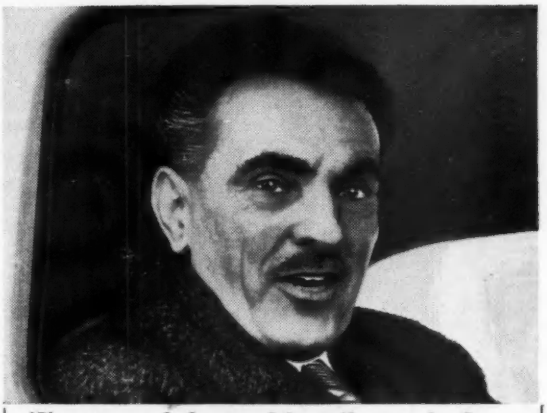

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process has some little effect, the nature and extent of such effects depends to a large extent on the type of coal carbonised.

TABLE 5.—PROXIMATE ANALYSIS OF COAL

Tests Description	AB Yorkshire	CD Yorkshire Slack	EF Durham Slack	GH Scottish	IJ Welsh	KL Yorkshire
Moisture, % ..	4.6	2.3	0.9	6.7	2.4	9.8
Ash, %	4.0	6.7	7.9	5.9	5.5	6.0
Volatile organic matter, % ..	36.3	32.8	30.2	32.7	34.0	32.0
Fixed carbon, % ..	55.1	58.2	61.0	59.7	58.1	52.2
Swelling Index ..	4½	7½	8	2	7½	4

TABLE 6.—GAS ANALYSIS

Test	A	B	C	D	E	F
CO_2, %	3.3	4.0	2.9	2.4	3.5	1.3
O_2, %	0.2	0.4	0.3	0.6	0.2	0.2
CnHm, % ..	1.9	2.2	1.7	2.6	1.8	2.7
CO, %	24.2	12.2	20.3	14.1	20.7	14.3
CH_4, %	14.2	24.4	21.6	21.3	16.3	21.2
H_2, %	52.8	38.7	46.0	40.5	53.8	43.5
N_2, %	3.4	18.1	7.2	18.5	3.7	16.8
Test	**G**	**H**	**I**	**J**	**K**	**L**
CO_2, %	1.9	2.7	2.8	2.1	2.2	2.1
O_2, %	0.5	0.2	0.4	0.2	0.3	0.2
CnHm, % ..	1.6	1.5	1.3	1.3	1.2	1.7
CO, %	18.8	27.6	22.4	26.5	19.9	22.5
CH_4, %	19.0	13.1	16.5	16.6	19.4	18.9
H_2, %	52.2	52.5	54.6	49.9	52.4	50.1
N_2, %	6.0	2.4	2.0	3.4	4.6	4.5

TABLE 7.—PROXIMATE ANALYSIS OF COKE (Dry Basis)

Test	A	B	C	D
Ash, %	7.9	7.5	11.8	10.9
Volatile organic matter, % ..	1.2	0.8	1.1	1.6
Fixed carbon, % ..	90.9	91.7	87.1	87.5
Test	**G**	**H**	**I**	**J**	**K**	**L**
Ash, %	8.8	9.4	11.7	12.2	11.1	10.2
Volatile organic matter, % ..	2.1	1.6	0.5	1.1	0.9	1.5
Fixed carbon, % ..	90.1	89.0	87.8	86.7	88.0	88.3

TABLE 8.—SCREEN ANALYSIS OF COKE

Test	A	B	C	D	E	F
Over 3 in., % ..	12.8	17.5	30.7	44.4	27.2	27.1
3 in. to 2 in., %	18.3	25.2	29.8	31.1	29.1	28.6
2 in. to 1½ in., % ..	23.9	23.6	13.9	11.1	19.2	16.4
1½ in. to ¾ in., % ..	21.3	16.6	14.2	8.9	13.5	14.0
¾ in. to ½ in., % ..	11.5	13.1	2.6	1.5		
Below ½ in., % ..	12.2	10.0	8.8	3.0	11.0	13.9
Shatter Index ..	—	—	79/88	60/79	50/77	53/75
Bulk Density, lb. per cu. ft.	—	—	21.0	19.3	24.1	23.9
Test	**G**	**H**	**I**	**J**	**K**	**L**
Over 3 in., % ..	7.7	—	13.3	12.8	9.8	7.2
3in. to 2 in., % ..	15.6	16.3	17.6	19.0	21.7	22·8
2in. to 1½ in., % ..	24.2	18.0	17.7	20.2	19.5	19.0
1½ in. to 1 in., % ..	25.4	34.9	20.8	22.5	21.7	22.0
1in. to ½ in., % ..	19.4	20.4	17.1	14.2	14.9	17.2
Below ½ in., % ..	7.7	10.4	13.5	11.3	12.3	11.8
Shatter Index ..	23/58	20/48	28/42	34/58	32/61	30/66
Bulk density, lb. per cu. ft.	21	19	22.5	20.0	18.5	19.3

TABLE 9.—TYPICAL ANALYSIS OF 'CARRIER' GAS

	Producer Gas	Blue Water Gas
CO_2, %	4.3	6.5
CO, %	29.2	38.9
CH_4, %	0.5	1.1
H_2, %	8.7	50.4
N_2, %	57.3	3.1

TABLE 10.—TYPICAL ANALYSIS OF TAR (Dry Basis)

Sp. Gr.	1.058
Free carbon	4.8%
Standard creosote	35.8%
Phenols in standard creosote	31.2%
Sp. Gr. at 60°C. of creosote	0.995
Paraffin fraction in standard creosote by chromotography	13.6%

Note: The specific gravity of the tar was reduced by the process. There was a tendency to form emulsions with water rendering the accurate determination of the tar yield difficult. Increases over steaming operation of up to 9 gal. per ton were obtained.

TABLE 11.—RESULTS WHEN RE-CYCLING COAL GAS *compared with manufacture of gas at the same calorific value by 'minimum' steaming.*

	Steaming	Re-cycling coal gas
Coal/retort/24 hr./tons	5.14	8.68
Average C.V. of gas, B.Th.U./cu. ft.	526	526
Gas made per retort/24 hr., cu. ft.	63,710	94,212
Gas made per ton of coal, cu. ft.	12,390	10,850
Therms per ton of coal	65.2	57.1
Therms per retort per day	335.2	495.5
Gas re-cycled:		
per hour, cu. ft.	—	3,840
per ton of coal, cu. ft.	—	10,050

TABLE 12.—NET COST OF COAL PER THERM

	Steaming	B.W.G. Admission
Calorific value of gas, B.Th.U.	456	456
Gas/ton of coal, cu. ft.	20,900	21,720
Therms/ton of coal	96.4	99.1
Coke made/ton of coal, cwt.	10.4	11.5
Breeze made/ton of coal, cwt.	1.4	1.3
Tar made/ ton of coal, gal.	15.6	22.5
Gas output/day, cu. ft.	4,000,000	7,925,000
Total gas—therms/day	18,200	36,200
Coal carbonised per day, tons	191	365
Coke made/day, tons	99.3	210.4
Coke used in producers per day, tons	21.0	21.0
Coke used for B.W.G./day, tons	—	51.2
Coke for sale/day, tons	78.3	138.2
Breeze for sale/day, tons	13.4	23.7
Cost of coal (80s. per ton), £	764	1,460
CREDIT:		
Coke (76s. per ton), £	297	525
Breeze (21s. per ton), £	14	25
Tar (8d. per gal.), £	99	274
For excess steam	—	16
Net cost of coal per day, £	354	620
Net cost of coal per therm, pence	4.7	4.1

TABLE 13.—*A modification of* TABLE 12.

If, due to the use of the larger sizes of coke for water gas manufacture, the price for the coke available for sale was reduced, or, alternatively, no extra tar was produced, the results given in Table 12 would be modified as follows:

	Reduced coke price		No extra tar
Cost of coal (80s./ton), £	1,460		1,460
CREDIT:			
Coke (66s./ton)	456	Coke as Table 12	566
Breeze Tar Steam as Table 12	315	Breeze Tar Steam	190
Net cost of coal/day, £	689		704
Net cost of coal/therm, pence	4.5		4.6

General Remarks

The various test results shown in the tables give in each case a comparative basis, but it is considered premature to attempt a general co-ordination. Various apparent discrepancies will be noted. These arise mainly from the effect of the process on different coals in the resulting variation of the gaseous hydrocarbons produced and the reduction of the CO_2 in the 'carrier' gas to CO. It has been found that under favourable conditions over 60% of the CO_2 in the carrier gas may be converted.

In Table 11 a comparison is given between the manufacture of a high calorific value gas (526 B.Th.U. per cu.ft.) by a low degree of steaming and by the use of re-cycled coal gas as a 'carrier' gas. It will be noted that, while an increased throughput and thermal output per retort were obtained, an appreciable loss in gaseous thermal yield per ton resulted.

The carrier gas used was not debenzolised. It is of interest to note that in the original patent of the West-Perkin process 'stripped' coal gas was specified as one of the possible 'carrier' gases. It is clear that the inventors anticipated (it is possible that they had proved in practice) that with normal coal gas degradation would occur when passing through hot coke. The use of gas from complete gasification systems as a carrier gas offers interesting possibilities although with this gas also some degradation would almost certainly take place.

It is therefore considered that blue water gas is the most suitable carrier gas. Later tests have shown that an output gas of 500 B.Th.U. per cu.ft. can be obtained when using water gas but with, of course, less marked increases in coal throughput. With reference to fuel consumption it will be appreciated that the consumption on a single unit setting, as used during these tests, is high and has little relationship to that on a normal installation.

The actual total consumption however remained substantially constant throughout the tests so that the percentage consumption on coal carbonised was reduced in proportion to the increase in coal throughput.

Economics of the Process

Since the assessment of the economics of any process can vary very considerably due to the basic data employed and the conditions applicable in each case, the value of any general statement is considered doubtful.

An approximate assessment of the effect of the process as applied to an installation having an output of 4 mill. cu.ft. per day when steaming, on the net cost of coal per therm, based on the results of one of the

series of tests, is given in Table 12. Under these conditions, and with the cost of coal, coke, etc., assumed a reduction of 0.6d. per therm is indicated.

If, however, it is necessary to use the larger sizes of coke for water gas manufacture and as a result a lower average price is obtained for the coke remaining available for sale, the reduction would be less.

Moreover, in the tests used as a basis a considerable increase in tar yield was obtained. This would not necessarily be the case in all circumstances and with all coals, and this increased tar yield has an appreciable bearing on the costs. The effect of these two factors are shown in Table 13.

With regard to operational costs it is obvious that the increased output would not be obtained with the same labour. In addition to the operational requirements of the water gas plant extra labour would almost certainly be required to handle the increased amount of coal and coke involved.

Maintenance costs would probably be lower, particularly those related to the refractory material of the retorts, due to reduction in surf formation and absence of slagging caused by steaming at the base of the retorts.

The main advantage of the process would appear to be its result on the capital cost per therm. This would depend, for instance, on whether the process was applied to (a) a works on which continuous vertical retorts and water gas plant already exist; (b) a works having existing continuous vertical retorts and where an increased output was required; (c) a new project.

These are only some of the factors involved; and since the economics must be examined in each particular case it is considered that an attempt to put forward any definite figures on the economic aspect of the process would at this stage be of very little value.

Another aspect of the economics of the process is the possibility of using cheap low-grade fuels. In this connection it is necessary to define the meaning of low-grade coal. If such fuel is of poor gas-making properties and high ash content, it is suggested that, while the first cost may be comparatively low in the ultimate economics of its use, particularly in view of its effect on the resulting coke, such coal may, in fact, prove to be expensive. Alternatively, if the description refers to small coal or slacks, as has been shown, these can be utilised with advantage. There is, however, some doubt whether any large quantities of such coal will be available and also there is a possibility that a demand for such coal for gas-making would result in an increase in price.

Conclusion

In the preparation of this paper two objects were in mind. The first was to direct attention to the necessity of examining existing methods of coal processing, to study the principles and, as far as they are known, the reactions involved, and to investigate the possibilities of modifying the procedure of existing methods and systems to obtain better technical and economic results.

The second object was to describe in some detail the results of such an investigation into a proposed method of plant operation which, while by no means new, had until recently not been fully explored or developed.

The object of the processing of coal is a very wide and fascinating one, and I am conscious of having dealt somewhat inadequately even with the small section covered by this paper. I trust, however, that what I have been able to submit to you will prove of interest and value.

I should like to thank your Chairman for his invitation to present this paper to you. I would acknowledge my indebtedness to Mr. Ernest West and the other Directors of West's Gas Improvement Company, who have not only made the investigation described possible but have given every encouragement during its progress. I would also thank my colleagues for their invaluable work during the investigations and their assistance in the preparation of this paper.

(The 'JOURNAL' report of the discussion will be published next week.)

Thos. W. Ward Ltd.

'Scrap metal' has a very unromantic sound, but its importance in the economy of an industrial nation is probably next to that of supplies of metallic ores and the fuel to produce from them the metals required in construction. The story of Thos. W. Ward, Ltd., is bound up with scrap, particularly scrap iron and steel. It is told in a handsome volume we have received from them, available to enquirers, we are informed, in strictly limited numbers.

It was as long ago as 1878 that young Thos. W. Ward started in business on his own account as a salesman of domestic coal and coke. Quite soon he expanded his business into the field of industrial fuel, 'especially foundry, blast furnace, and blacksmith's coke.' What more natural than further expansion into the provision of 'all manner of minerals and raw materials then needed by ironmasters and foundries'? It must have been then that he realised the growing importance of scrap and applied himself to the finding, preparing, and supplying of the scrap iron and steel demanded in ever-increasing quantities as the country's iron and steel industry grew to its present vast proportions.

Finding the scrap meant ever greater ventures into demolition of all manner of structures—and ships. There was romance in many of these. And adventure, too, we may be sure, in the valuation and purchase of structures of forbidding proportions on the chance of finding a market for the retrieved metal. Among other examples were the wreckage of the ill-fated airship R101, the structure of the burnt-out Crystal Palace and many famous ships, including the battleships Rodney, Revenge, Nelson, and Royal Sovereign.

Later, Wards went into engineering, civil and mechanical, on their own account. The list of the undertakings they now control is long and imposing. Quarries of limestone, granite and sand, for building, road-making and foundry purposes, include such well-known names as Doveholes, Shap, Ketton and Gwydyr. Tarmacadam is developed in no fewer than seven undertakings. Wagon-building and repairs are carried on at eight different works; not forgetting subsidiary and associated engineering companies which include such famous names (giving them in their familiar forms) as Dick's Asbestos, Low Moor Iron, Thomas Smith of Rodley (for cranes), Widnes Foundry (for structural work), John Fowler of Leeds, and Marshalls of Gainsborough (for steam engines). We have just picked out those which have a place in our memory with no idea that they are more important than those omitted. And Wards have gone abroad with offices in France, India, Scandinavia, and Australia.

Thos. W. Ward, Ltd., is an instance of the vast amalgamations which are a feature of our modern economic structure; and while their operations have no particular connection with the gas industry, except where they have participated in gasworks construction and reconstruction, we shall not withhold our admiration of the business acumen and spirit of adventure which have brought them into existence and to success.

ASHTON.

The principal event of 1953 for the National Illumination Committee, which has just published its annual report, was the meeting with the President of the International Commission on Illumination, Dr. Ward Harrison, on June 11. The President indicated that the 1955 meeting of the Commission would be held in Zurich. He also reported that Brazil has become a full member of the Commission.

The Institution of Gas Engineers has published the Gas Council's Research Communication GC10/9—the introduction, presentation, discussion, and reply edition of the 44th Report of the Joint Refractories Committee: 1952-53—presented and discussed at the Autumn Research Meeting in London last November. Copies of the publication, and also of the original Report to which it relates, are obtainable at 1s. 6d. each from the Institution.

From the National Smoke Abatement Society we have received a copy of *Proceedings* of the Glasgow Conference, 1953. The volume is of particular interest because of the reports it contains on the London fog disaster of 1952, and the papers on the production, use, and availability of solid smokeless fuels. Progress towards the elimination of domestic smoke depends very largely on the extent to which the production of solid smokeless fuels can be developed, and these papers provide a most important analysis of the problem. The discussion that followed will also be found of considerable interest. The *Proceedings* also contains a lecture by Sir John Charles, Chief Medical Officer, Ministry of Health, the Presidential Address by Alderman Professor F. E. Tylecote, and a paper on 'The Efficient and Smokeless Combustion of Fuel Oils.'

INTEGRATION PROBLEMS

FROM A PAPER TO THE MIDLAND JUNIOR GAS ASSOCIATION ON MARCH 23, 1954, BY

F. L. ATKIN,

M.I.Mech.E., M.Inst.Gas E., Chief Distributing Engineer, West Midlands Gas Board

It is sometimes assumed that integration begins and ends with the laying of pipes between gasworks. This is far from the truth. There is more to be done before one can think of calculating even the pipes sizes. For the purpose of what I intend to say I have divided this problem into three sections—*viz.*, 'Economical,' 'Technical,' and 'Practical.' Of these three items economics seems to me to be vital. Engineering economics has to be conditioned by future requirements—to my mind, a hazardous business.

What is likely to be the demand for gas during the next 20 years? This is a question we have to face. It is a difficult question to answer; and existing data are not too helpful. There were increases due entirely to the last war, and the question arose of the prudence of installing additional plant. It seemed that, when the war was over, the use for gas would revert to its pre-war position. Most of those employed in the gas industry thought that a reduction of up to 20% would occur. Subsequent events proved that such pessimism was well wide of the mark. In the event, unrationed fuels benefited by the shortage of solid fuels. The shortage of houses increased the use of the older types of houses by conversion into multiple dwellings with increased gas usage per original dwelling. Lack of labour provided a ready opening for married women to continue at work, with a consequent increase in the use of labour-saving appliances which are so readily supplied by gas. The demand for extra goods for home and export required extra gas for industry.

I should think that 65% of the gas sold to domestic consumers is used on the domestic cooker. At present the industry is installing three or four times as many cookers as the electrical or solid fuel industries.

Assessment is Difficult

While the number of new family units will increase over the next 20 years, it will probably be at a decreasing rate. It is these new family units to whom we must look for our increase in domestic load. New houses do not necessarily mean new family units and therefore new consumers. Many are, in fact, replacements, and generally speaking, replacement takes the form of a modern cooker, and there is a tendency for the new consumer to use less gas.

Assessment of future industrial loads is difficult. The industrial user prefers gas, but competition has caused him to examine closely the cost of the items which go to make up his product. If the cost of fuel is a large slice, he is greatly concerned with initial cost. Taking current conditions into consideration, however, I feel that the industrial load will increase.

No area, at vesting day, had sufficient traditional gas-making plant to enable the estimated demands to be met over the next 20 years, though it may be that some areas had an overall surplus which could be made available for the next five or six years. In such cases it is reasonable to plan integration mains and equipment to provide for the future, the while considering their present availability.

It cannot be assumed that a small undertaking, which is producing gas at a reasonable cost per therm, is economic. Maybe it will be necessary to replace plant, thus putting that undertaking into the uneconomic class due to the capital charges on the new plant. The gas-making capacity of the units to be closed down, plus the estimated demands for a number of years ahead, is a measure of the additional amount of gas required. Some boards have at their disposal large quantities of coke oven gas, a few have a small amount of coke oven gas, others have none at all. A small quantity of methane from mines drainage has become available. At present the total amount would not have much bearing on gas demand. As to natural gas, the Gas Council is spending £1 mill. (spread over five years) on exploration. It is hoped that success will be achieved, and obviously we await the results with interest.

The production of gas from oil offers promise; and experiments are being carried out by the West Midlands Gas Board. Another development which is of interest is the increase in throughput from existing continuous vertical retorts.

Cost of Compression

The difference between plants which produce gas at atmospheric pressure and those which produce at higher pressures has an important bearing on the cost of gas distribution. The distribution of natural gas in America, Italy, Holland, India, etc., bears no comparison with the transmission of gas from gas-making plants producing gas at atmospheric pressure. For instance, with power at 0.85d. per B.H.P. and an overall efficiency of 70% (figures which are favourable), and making allowances for capital and maintenance charges, the cost per therm to compress gas is as follows:

25 lb. per sq. in.	0.376d. per therm
100 lb. per sq. in.	0.561d. per therm
1,000 lb. per sq. in.	1.65d. per therm

At first sight these figures do not appear to be significant; but when they are translated into annual charges, the picture is quite different.

Assuming that 12 mill. cu.ft. per day for 300 days has to be transmitted, then the extra charges due to compression at 100 lb. per sq. in. instead of 25 lb. per sq. in. is 0.185d./therm, equal to £12,500 per annum which, at 6½%, represents a capital outlay of £192,500. Alternatively, if 1,000 lb. per sq. in. is considered instead of 25 lb. per sq. in., the difference of 1.224d. per therm is represented by capital charges of £1,320,000.

In regard to gasholder storage, I am of the opinion that 12 average hours per 24 hours of maximum day is sufficient to enable a bulk supply to be given at an average rate on a maximum day and to allow variations in the consumer demand to be met. Something less would be sufficient where there is a large industrial consumption possessing a high load factor demand.

In regard to small towns, it will be found usually that the size and cost of the main, and the cost of compressing, favours holder storage.

Having assessed the load, provided for gas availability, and decided on the types and sizes of holders, we have to determine the maximum quantities of gas which have to be transmitted between various points. There are two factors to consider—diameter of pipe, and pumping pressure. The method of assessing the optimum diameter and pressure was only presented in 1927 by Mr. Stephen Lacey in a paper to the Institution of Gas Engineers. The fundamental methods he enunciated remain sound. The conclusions he came to were conditioned by the economic circumstances of his day. Consequently some of them are not now relevant, but over the course of the last two or three years many excellent papers have been given to the Junior Gas Associations which have followed closely principles laid down by Stephen Lacey.

The calculations enunciated by Lacey are straightforward. But there are eddy losses due to change of direction and due to the passage of gas through restrictions, such as valves, governors, etc. However, calculations are usually made on the nominal diameter, whereas spun iron pipes are larger, especially in the smaller sizes. These factors, together with variations in specific gravity and viscosity, roughness of the pipe, effects of deposits and elevation, etc., could have a cancelling effect. They

could also be cumulative. By and large, time spent on the use of a precise mathematical formula is of no great advantage.

When we turn to practical considerations, the question arises whether we shall use cast iron or steel pipes. If theory has indicated that the future economic pressure will be more than 35 lb. per sq. in., then we must use steel pipes. But from my experience of the bulk supply schemes which are being considered, the economics usually result in large diameter mains with medium pressures.

Cast Iron or Steel ?

Cast iron pipes are reliable—with one or two exceptions. There are miles of large diameter cast iron pipes performing a useful service which have been in the ground for more than 70 or 80 years with no protection, and, as far as can be seen, are likely to go on for a similar number of years. Cast iron has proved its worth as far as corrosion resisting is concerned, even in soils which would rapidly corrode steel. Cast iron, being a brittle material, must be properly supported; and, apart from subsidence, breakages in cast iron are usually attributable to faulty mainlaying or to the fact that materials such as brick or rock have been left on the bed of the main. Even in certain subsidence areas, spun cast iron, with flexible joints, has proved perfectly satisfactory. Of course, much depends on the area. For instance, in the Stoke-on-Trent area, due to the depth and method of working of the mines, cast iron is out of the question.

The Pipes Committee of the Institution of Gas Engineers has suggested that cast-iron pipes should not be used for internal pressures greater than 35 lb. per sq. in. They have, however, been used for pressures up to 50 lb. per sq. in. and even up to 100 lb. per sq. in. If it is thought likely that pressures will exceed those which are beyond the capabilities of cast iron, then there is no option but to use steel. Though mechanical joints can be used (flanged joints are most unsatisfactory underground), the most convenient way of jointing is by welding.

A welded joint can be stronger than the pipe itself, but the efficiency of the joint depends, to a great extent, on the workmen. They must be well skilled and close supervision must be exercised. Apart from normal leak-testing methods, the joints can be examined either by ultrasonic means or by gamma-ray testing. This procedure is expensive, but where high-pressures are involved it is probably worth while.

Protection Against Corrosion

As the external surface of the pipe is affected by corrosion, some means must be adopted for its protection. I recommend that pipes should be pickled and phosphate-treated prior to coating with bitumastic solution or red lead paint. The pipes are then covered with bitumastic sheathing; this may be done at the factory under controlled conditions; but, of course, the joints have to be completed on site.

In America, in addition to sheathing, it is becoming common to install cathodic protection of either the magnesium alloy anode or the impressed current type. Provided this is applied to new work the cost per mile is not very high and may be regarded as an insurance. Cathodic protection is no substitute for external mechanical protection for large mains. The number of anodes required would be difficult to accommodate. Electrical drainage in a built-up area where other services are present is a difficult proposition. It could, in fact, increase corrosion.

Apart from the technical advantages and disadvantages of cast iron and steel pipes, the question of cost must be considered. Obviously size for size, the excavation, laying, backfilling, and reinstatement, cost practically the same whether cast iron or steel is used. There is insufficient experience on the welding of steel pipes in this country to make any comparisons of cost, but I would not think that the average cost per yard for welding is very much different from the use of mechanical joints. In this country, yard for yard, steel pipes remain more expensive than cast iron. If steel pipe makers can reduce their prices, then it may pay the industry to investigate new techniques of jointing.

Pressure-Raising Plant

For pressures up to 2 or 3 lb. per sq. in., multi-stage boosters can be used and considerable volumes can be handled in one machine, up to 2 mill. cu.ft. per hr. Between this pressure and 7 to 10 lb. per sq. in. rotary compressors of either the blade or rolling drum type can be used, the limits per machine being of the order of 1 mill. cu.ft. per hour. For pressures above 10 lb. per sq. in. and at modest volumes the reciprocating compressor is the best proposition, the limits in volumetric capacity per machine being 500,000 cu.ft. per hour.

From 250,000 cu.ft. per hour and upwards, centrifugal compressors can be used which are capable of pressures up to 20 or 30 lb. per sq. in. The latest development in this field is an axial-flow compressor, similar to those used for gas turbine technology.

Integration in the West Midlands

A survey immediately following vesting date of potential demands and availability of gas supplies indicated that there were no surplus supplies. Also, no new plant of substantial size could be brought into operation in the immediate future. The position was so serious that industrial supplies had to be examined carefully prior to acceptance. To this situation was the added burden of general increases. There were no hopes of closing down any works (apart from a couple of very small ones) and the immediate problem was whether any manufacturing plant could be quickly extended, and, if so, whether mutual aid could be provided by interconnection.

It was possible to take certain steps in this direction, but it was desirable that such interconnections should fit in with the final picture, particularly as the quantities of gas to be transferred were not inconsiderable and we were thinking in terms of 24-in. mains in built-up areas—an expensive business.

The predominant area is the central conurbation of Birmingham and the Black Country, roughly elliptical in shape, 22 miles by 18 miles, with its major axis running south-east through Birmingham, and north-west through Wolverhampton. Of the gas distributed by the Board, 62% is used in this area, which is served by 19 works. The other two major industrial areas are centred around Coventry and Stoke-on-Trent. These three areas together account for 85% of gas distributed in the area. Apart from small towns and their satellites, there are the rural and semi-rural areas of Shropshire, Worcestershire, Herefordshire, and parts of Warwickshire and Staffordshire.

At vesting date the shortage of manufacturing capacity was especially noticeable in the central area (Birmingham and the Black Country), Stoke, and Coventry. Reverting to the central area, it will be appreciated that the density of houses and factories, and therefore the concentrated demand, presents special features and problems. A certain amount of mutual aid between undertakings had been possible due to the juxtaposition of supply areas, and some interlinking permitted a limited amount of gas to be transferred.

To extend this interlinking without taking cognisance of future manufacturing plants would have been most imprudent. To give details is impossible in the time at my disposal, but I will, for record purposes, present a few figures, as follows:—

The plant capacity at vesting day was 251,400,000 cu.ft. per day.

The plant capacity added since vesting day, 56,600,000 cu.ft. per day=22.6%.

The increase in output since vesting day:—

1949-50	3.4%
1950-51	8.2%
1951-52	2.5%
1952-53	.2%
1953	.2%

equivalent to 14.2% over the five years.

At present the plant under construction or authorised is 62,500,000 cu.ft. daily capacity from which must be deducted 12,500,000 cu.ft. for obsolescent units, giving

a net amount of 50 mill. cu.ft. This, together with the plant brought into operation since vesting date, represents an increased manufacturing capacity of 42%. At first sight this seems to be a reasonable margin, as it represents a further 10 years provision if the average rate of increase is equal to the last five years. There are, however, two important points to remember. Firstly, that the existing plant is ageing and cannot necessarily be assumed to be in operation in five or 10 years, and, secondly, that it still takes a number of years to plan and complete new plant.

W.M.G.B. Grouping

Integration has taken place in groups or areas centred round one or more undertakings. These interlinked groups have been linked with each other to form an integrated whole. The groups are roughly as follows:—

(a) Walsall, Cannock, Lichfield, Tamworth, and Rugeley.
(b) Wolverhampton, Bilston, Dudley, Tipton, and Willenhall. (Wolverhampton Division, Northern Section.)
(c) Dudley, Cradley Heath, Rowley Regis, and Sedgeley. (Wolverhampton Division, Southern Section.)
(d) Birmingham (Swan Village), West Bromwich, Oldbury, and Smethwick.

These groups are, or will be, linked with each other at one or more points—e.g., Walsall New Works at James Bridge with Swan Village; Lichfield and Tamworth with Birmingham (Mere Green); Walsall with Birmingham (Wednesbury); Wolverhampton Northern Section with Walsall New Works (via Willenhall); Wolverhampton northern scheme with the southern scheme at Dudley, and Dudley with Birmingham (Swan Village).

In addition to the central area, Stoke-on-Trent is, or will be, linked with Newcastle, Leek, and Cheadle; Stafford with Stone, Penkridge, and Brewood; Kidderminster with Stourport and Bewdley; Worcester with Malvern; Malvern with Colwall, Ledbury, and Upton; Coventry with Leamington, Rugby, Hinckley, Nuneaton, and Atherstone; and Leamington with Warwick. In addition, Birmingham is linked with Coventry.

Integration in the West Midlands, especially in the central area, is quite a different problem from linking-up a scattered area of medium and smaller undertakings with relatively small diameter mains, where, as a rule, the capital involved is not large and the small undertakings are frequently producing high-priced gas, so that it is not difficult to present an advantageous picture, especially when the parent unit has surplus capacity, or other sources of gas are available.

In the West Midlands, the problem has required, and still requires, considerable thought. Firstly, because there was a deficiency of gas manufacturing capacity; secondly, because the majority of the undertakings were of a reasonable size producing gas economically; thirdly, due to the difficulty of deciding what new plant was desired and where it could be placed; and, finally, accommodating the large mains required in a closely built-up area. However, so far 24 miles of integration mains has been laid, and a further 70 miles has been authorised. The total estimated cost, so far, of integration mains laid and authorised in the West Midlands is £1,112,000.

Other interesting statistics are that at December, 1953, the Board had 1,061,300 consumers and since vesting day has provided 74,759 new services. Services are being renewed at the rate of 7,000 per annum and cleared at the rate of 30,000 per annum.

DISCUSSION

Mr. J. A. Milner (Worcester) expressed his preference for steel pipes, and disagreed with the view that they were more costly than cast iron pipes.

Mr. **Atkin** said he could not agree as to relative cost. There were many districts in the West Midlands suffering from small diameter mains and high pressure compressors supplying gas at high pressure. This was uneconomical compared with cast iron pipes and medium pressure.

Mr. **J. Foxton** (Cheltenham) said that, if integration was to pay, they should have works which could with reasonable efficiency give them a surplus of gas. In an area where the population was fairly dense integration was a paying proposition, but he thought to-day there were many people who were bowing to integration for its own sake. In some areas integration would put a very high capital cost on gas.

Mr. **Atkin** agreed that integration for integration's sake would be wrong. He had always taken that view, and, as he had pointed out in his paper, there must be economic support for any scheme.

Mr. **A. V. Wainwright** (Shrewsbury) said that in the interlinking of small undertakings a point which had to be considered was variation in calorific values. Obviously, if there was going to be integration there must be a common basis. Had this difficulty been experienced in rural areas?

Mr. **Atkin** replied that this was a difficult problem to which much thought had been given. Variations in calorific value would make a difference; another point was specific gravity, which would have an even greater effect on the carrying capacity of the mains. In rural areas where the density of population was not great, 3-in. and 4-in. mains could usually cope with the variations, but difficulties might arise in trunk mains of 6-in. and 8-in. diameter. The average consumer was unknowingly tolerant concerning variations of calorific value and specific gravity as he appeared to judge the standard of performance by the pressure of the gas.

Mr. **D. J. Ward** (Birmingham), discussing prime movers, suggested that electricity was not sufficiently reliable for important plant. He thought steam or diesel preferable.

Mr. **Atkin** said he agreed that steam prime movers were most reliable. Power costs were important and, generally speaking, it did not pay to generate steam for power only, but where the power required could be integrated with the process requirement the picture was quite different. He was surprised that the production engineers did not make more of this undoubted advantage.

Mr. **H. J. Reynolds** proposed a vote of thanks to Mr. Atkin, and Mr. **S. C. Crathorn** seconded.

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Proposed New Gravesend Gasworks

Chief Engineer Describes the Scheme

A scheme for the construction of a major gasworks at Gravesend, to become in time the main source of gas supply to North Kent and the Medway towns, was described by Mr. R. Prince, Chief Engineer of the South Eastern Gas Board, at a special meeting of the South Eastern Gas Consultative Council on April 6. The information given by Mr. Prince was supplemented by Mr. R. H. Sandford Smith, Secretary of the Board, and Mr. J. E. Davis, O.B.E., Chief Technical Officer.

Emphasising that gas was produced at the lowest cost in major works sited to receive seaborne coal direct, Mr. Prince said that it was the general policy of the South Eastern Gas Board to concentrate gas manufacture at large riverside or coastal works where coal could be received direct from the Board's fleet of colliers. So far as the meeting was concerned, this long-term planning provided for the extension of the existing works on the Thames at Wandsworth, Rotherhithe, and East Greenwich, together with an additional works which it was desired to locate east of Gravesend.

Long-Term Expansion

The demand for gas in the London divisions and North Kent was at present met by 32 individual gasworks with a total maximum productive capacity of 187 mill. cu.ft. per day. It was estimated that this demand would increase to 238 mill. cu.ft. by 1964-65, which meant that, after making the necessary allowance for repairs to plant, 252 mill. cu.ft. per day must be budgeted for by that year. There would be a deficit of 43 mill. cu.ft. per day by 1964-65, which it was to cover this deficit that a new works was needed. While he had spoken only of the manufacturing requirements in 1964-65, it would be understood that some gas would be required progressively in the years preceding that date, and the planned production showed that additional quantities of gas should be made available initially as from the winter of 1959-60.

The selected riverside site immediately east of Gravesend extended to some 150 acres. This was rather more than was required for a works of 43 mill. cu.ft. per day capacity, but in choosing a site it was always necessary to have regard not only to foreseeable requirements but also to the long-term position. They regarded a 72 mill. cu.ft. per day capacity works as being likely to be required ultimately, and provision must thus be made now to ensure an economic development.

A Favourable Site

The provision of a jetty was necessary to cover the acceptance of coal from the Board's colliers, carrying 4,000 tons of coal on each journey from the north-east coast. The river at this point was suitable for such an installation, and preliminary negotiations had led them to believe that their proposals would, in principle, be acceptable to the Port of London Authority.

From the gas transmission and distribution point of view, Mr. Prince explained that the site was also notably favourable. There was no gas manufacturing station on the south bank of the Thames along the 25-mile stretch between East Greenwich and Gravesend and the developing needs of this important area, at present estimated at 15 mill. cu.ft. per day, were met by the combined production of the obsolete works at Dartford and Gravesend and by a bulk transmission of the balance of requirements from East Greenwich and Sydenham. In addition, the demand for gas in the Medway towns was fast outstripping the capacity of the Board's works at Rochester and Gillingham. The Rochester works site was unsuitable for major development, and the Gillingham site was already fully developed and incapable of efficient and economic extension. The most economical means of affording increased gas supplies to these districts was from the proposed Gravesend site, which was some five miles distant.

Under the South London Distribution Scheme, the major works at East Greenwich was being interlinked with works to the west and south to cover gas supplies in these parts of the area. There were objections to linking a wider area with the one works, and therefore a similar major works was required to provide supplies over the eastern area comprising Belvedere, Erith, Crayford, Dartford, Swanscombe, Northfleet, Gravesend, and the Medway towns.

The site was conveniently placed for rail and road access and no difficulties were expected in this respect. Moreover, the considerable volume of cooling water needed for a works of this size could be drawn from the river. Fresh water requirements for coke quenching, steam plant, and domestic use would, on full development of the works, reach 40,000 gal. per hour. This quantity was not likely to be available from the town supply and permission would be sought for the sinking of artesian wells.

Orthodox Plant

While in the preliminary stages the Board had planned gas production plant of an orthodox character, it had borne in mind the need to make the best use of raw materials available within its area. The Isle of Grain Refinery provided two sources—the residual heavy oil and the 'tail' gases, both produced in the refining process. The heavy oil would be brought to the new works direct in specially equipped heated railway tank wagons (hence the need for good rail facilities), while the 'tail' gases would be conveyed by pipeline to the works without passing through heavily built-up areas.

Mr. Prince explained that the Board's proposals for the new works were not put forward in time for consideration when the Kent County Development Plan was being prepared. It would be realised that after vesting day the Board was faced with a formidable task in taking over 61 separate undertakings and ensuring their continued operation. Concurrently, local planning authorities throughout the area were preparing their development plans, which involved the Board in an immense amount of work in making sure that provision was made for their future needs.

Application for Planning Permission

In the case of the Kent County Council's development plan it had not been possible to have the Board's proposals for this Gravesend scheme ready in time for inclusion in the plan, and hence application for planning permission for the project had to be made. Although permission had been refused, the Kent County Council and Gravesend Borough Council had co-operated with the Board to try and find a site to meet the Board's needs and to solve the various difficulties. The possibility of moving the proposed site somewhat to the east was being explored and this would meet many of the difficulties with which the Borough might be faced, although they still felt that the amended proposal would not do away with the fundamental objection on amenity grounds. The amended proposals were being considered by both the County Council and the Borough Council.

Unless an alternative site which was satisfactory to all parties was found, the Board would have to appeal to the Minister of Housing and Local Government against the refusal to grant planning permission and a public enquiry would probably be held.

On the question of the local amenities being affected by the emission of dust, Mr. Prince explained that the proposed carbonising plant would comprise intermittent vertical chambers which, together with the adoption of modern handling plant and other measures, would, according to his experience, give little or no cause for complaint. While the present proposals were planned on orthodox lines, any modern development in gas production would be applied if economically sound and capable of being operated under not less favourable conditions from the point of view of amenity, he concluded.

Members' Questions

One of the first questions asked concerned the use to which 'tail' gases from the Isle of Grain refinery would be put. The point was explained by Mr. Davis, who said that the Board was attempting the biggest thing in gas development since the East Greenwich works was planned by Livesey in 1881. At that time there were four retort houses and first-class coal was available. So far the Board had depended largely on the East Greenwich works for its main supply to South London. Conditions now were very different from those obtaining in 1881, when the use of oil was unheard of; the oil would not just be burnt but used as a raw material to supplement coal.

Another questioner enquired about the possible danger from flood water, and also asked what was likely to be the estimated capital cost of the works. In reply, Mr. Prince said that the River Board was carrying out a large scheme in flood prevention, and the Gas Board was entirely happy in the belief that the site chosen would be perfectly satisfactory. It was, in point of fact, 4 ft. below flood level, but that was not re-

garded as an obstacle. The project was being planned on the grounds that orthodox plant was to be used. They would take advantage of modern developments, provided that the results obtained were better, or at least no worse, than orthodox methods. Roughly speaking, when fully developed, the total cost was expected to be in the neighbourhood of £6 mill.

Another question dealt with the supply of employees—how many would be needed to man the new works, how would they be housed, and what would happen to those now employed at existing works which would, in course of time, be closed down? The questioner was also concerned about the possible disposal of effluents into the river.

Mr. Prince explained that, as the old works were closed down, so the labour would be transferred. It was anticipated that, initially, approximately 300 men would be employed, and that ultimately, when the works was in full production, the number would be about 1,000. It was not anticipated that there would be any shortage of labour or any difficulty concerning the housing of employees. The Medway towns would be the chief source of labour for the works, and as far as housing was concerned it was not anticipated that it would be necessary to seek the assistance of the Gravesend Council.

In answer to a question regarding the works to be closed down, Mr. Prince said that these would probably include Rochester, Snodland, Dartford, and, of course the present Gravesend works. It must not, however, be thought that this would happen in the very near future; it would be a gradual process stretching over a considerable period of time.

Alternative Sites

Two members of the Council referred to the possible existence of alternative sites for the new works. One member wondered how wide had been the search for an alternative site. In reply to this question Mr. Prince explained that a most exhaustive search had been undertaken from Dartford away to the north east cliff; nowhere had it been possible to find a site which offered the same advantages as that now under consideration, or which the Board would be prepared to accept.

The other questioner about this matter, Councillor G. Wickham Pagett, explained that in a sense he had a foot in both camps since he was not only a member of the South Eastern Gas Consultative Council, but also a member of the Kent Planning Committee, which had rejected the Gas Board's proposal. They had done so under pressure from the Ministry of Agriculture and Fisheries, who were trying to preserve the fertile lands of Kent. It had been decided that no further residential or industrial development would take place east of Gravesend. He had been given to understand that to the east of Gravesend there was a stretch of alluvial land particularly suitable for market gardening. It was in the interest of preserving that type of land in Kent from encroachment that the decision had been made. There was also the question of water supply; this had been dealt with in the Kent Water Bill of three years ago, but since this the Isle of Grain Refinery had appeared, with its colossal requirement of water. Already water supply was falling short of demand. The question of labour and housing was another factor in the decision to reject the scheme. Ultimately, of course, there would be an appeal to Whitehall, with whom the answer must rest, but his object in making this point was to present the Kent Planning Committee, not just as an obstructive body anxious to put a spoke in the wheel of the Gas Board, but a conservative body doing its best to preserve the area according to its policy.

Half as Big as Beckton

Mr. Prince said the envisaged works would not be as large as Beckton, as had been suggested in the Press. That was quite untrue; in fact the works would be roughly half as big. He would also like to emphasise the fact that both the Kent County Council and the Gravesend Borough Council had been extremely helpful. As far as water supplies were concerned, he did not think there need be any cause for anxiety since they would use deep bore methods to meet most of their requirements. On the question of disposal of effluents, these would be taken back to the chemical works at Greenwich by barge. No effluent of a noxious nature would be released into the river.

A strong point in favour of the new works was made by one member of the Council, who pointed out that in gaining a new, clean, dust-free works, Kent would be losing old, dirty, dust-laden works, some of which had been cause for complaint in the past; that seemed to him to be a big step forward.

Another member referred to the unpleasant but unavoidable threat of war. In the event of war, he said, such a large works would surely be very vulnerable. His point was answered by Mr. Sandford Smith, who pointed out the advantage of such a works linked to other major works in preserving gas supplies at times of emergency.

Lastly, the effect of the new works on rates was raised by the Chairman of the Consultative Council, Councillor A. B. Constable. Mr. Prince pointed out that new legislation in regard to rates was pending, and with the new method of rating, the contribution to the rates was estimated at about 2s. in the £, and Gravesend would benefit to that extent. Although he was loth to prophesy, it was reasonable to suppose that the new legislation would not alter that figure very much.

Midland Juniors President's Day

President's Day of the Midland Junior Gas Association was observed on April 1. The President for 1953-54 is Mr. J. A. Tomes, Stourbridge, and a successful year of office is drawing to a close. In the morning a tour was made of the gasworks at Stourbridge and at midday about 250 members of the Association and visitors were entertained at luncheon at the Wulfrun Hall at Wolverhampton at the invitation of the Chairman and members of the West Midlands Gas Board.

Mr. Tomes occupied the Chair and a representative company included Mr. G. le B. Diamond (Chairman of the West Midlands Gas Board), Mr. H. J. Reynolds, Mr. S. C. Crathorn, Mr. W. Macnaughton, Mr. A. W. Lee, Mr. F. H. Cureton, Mr. F. C. Briggs, Mr. J. E. Wakeford, Mr. C. F. W. Rendle, and Mr. S. Brockbank.

The toast of the West Midlands Gas Board was proposed by MR. H. J. REYNOLDS (Senior Vice-President), who spoke of the Juniors' appreciation of the way in which the Chairman and members of the Board supported and encouraged the Association. Before nationalisation he was a member, as he still was, of the executive committee of the British Junior Gas Association's Joint Council and he recalled that at that time some consternation existed as to what might be the future of the Junior Associations when nationalisation came along. Much effort was put into preparing a case for submission to the Gas Council. He had wondered whether it was waste effort, because he felt sure the Associations and their work would be appreciated; he flattered himself on turning out to be a true prophet.

They were delighted with the treatment they received from the West Midlands Gas Board and he knew that the other 10 Junior Associations received similar treatment from their respective boards.

MR. DIAMOND, responding to the toast, said the Board had a high regard and esteem for the work being done by the Junior Gas Association as well as by the whole of the staff. He commented on their enterprise as a Junior Association in making the visit to the Continent, which they were to make at the end of May—at their own expense—to see something of the gas industry as exemplified in France. The visit was going to be well worth while, and he would look forward to hearing what they thought about the development that had taken place since the nationalisation of the French gas industry. He had been impressed by some of the things that had been done.

The Board had just completed its fifth year, and he was happy to say that the year would show an increase in gas output of between 0.1 and 0.2% as compared with the preceding 12 months. In the early part of the year they suffered from a trade depression and from the Austin strike. They were then lagging behind most of the other boards; but they had overhauled some leeway and had come out with the gas output better than had been anticipated.

He paid a tribute to the engineers, through whose efforts an improvement in the thermal yield had been brought about. The average for the year would again be increased by approximately one-third of a therm. The figure was 78.8 therms per ton for the area and they were still unbeaten over the whole of the country although one or two areas ran them very close.

As to coke and breeze the net production figure would be approximately 10½ cwt. per ton of coal carbonised, which was an increase of 0.2 cwt. on the previous year. That result had only been achieved by an immense amount of individual attention in the retort house and on the production side.

MR. R. DAVIS (Chief Accountant, West Midlands Gas Board) proposed the toast of the Midland Junior Gas Association. He said, as a comparatively newcomer, he had been impressed by the institutions and traditions which sustained the industry.

MR. TOMES, in his reply, recalled that the programme for the session had consisted of five papers, an address, and five visits. There still remained the

visit to be undertaken by some 30 members to Paris, and he hoped that a report and a film record would be prepared on the visit for presentation at a meeting during their jubilee year.

Quickening Tempo

The object of the programme was purposeful—to promote interest and knowledge, since in their industrial life they needed, he believed, more than anything else the note of expectancy and faith in the future of their industry. There was little doubt that the gas industry was on the threshold of new techniques, which would be developed with an ever quickening tempo. They were fortunate inasmuch as nationalisation made possible their detailed investigation, thus enabling their practical and economic merits to be accurately assessed, which was so vital since selling price must always be the yardstick by which the efficiency of the industry was judged.

In these conditions increasing specialisation was inevitable, and their Association must be prepared to adapt itself to meet the needs of its members in future as it had done in the past. He had heard it said that the Juniors were a tradition in the gas industry. While that might be true, he felt they were there to make tradition and not to accept it. He expressed thanks to the Council and to the Secretary, Mr. H. J. Reynolds, for their help during his year of office.

A presentation to Mr. A. W. Lee (reported in the 'JOURNAL' of April 7) followed, and in the afternoon the members and visitors divided into small parties and inspected a number of glass works in which they saw how gas contributes to the success of an important industry.

Over £1 Mill. Spent in Fife

Since the nationalisation of the gas industry, £1,013,000 had been spent in Fife on schemes of a capital nature, said Mr. David L. Dickson, Dunfermline, Manager of the Fife Group, Scottish Gas Board, in an address to Dunfermline Business Club. Mr. Dickson said that the developments included carbonisation plant, drainage, major link-ups to housing schemes, and offices.

Before nationalisation, there were 23 individual gas-producing units in Fife. During the last year, efforts had been made to cut out inefficient undertakings, and there were now 17 individual units. This number would be further reduced to about 12 within the next year or two.

At Dunfermline, the gas plant was highly efficient, and £500,000 had been spent on it during the last five years. The industry at Kirkcaldy was also efficient, but its operations were of an extremely limited size. The plant at Leven was being brought up to date. Mr. Dickson pointed out that, in the process of investigating existing undertakings, the industry was developing new and more efficient methods.

Women's Gas Federation.—The 10th annual general meeting of the Women's Gas Federation will be held on May 25 at Caxton Hall, when 500 delegates from over 40 branches will attend from all over Britain. Speakers will be Lady Burnham, Chief Commissioner for England for the Girl Guides, wife of Lord Burnham, Chairman of the *Daily Telegraph*, who will take for her subject, 'The Value of the Home,' Mr. Geoffrey Lloyd, Minister of Fuel and Power, and Sir Harold Smith, Chairman of the Gas Council.

Western and Wales Juniors

The Western Junior Gas Association were hosts on March 27 to the Wales and Monmouthshire Junior Gas Association when a joint meeting was held at Cheltenham and a paper, 'Aspects of Accountancy,' was presented by Mr. W. E. Baggs, Chief Accountant's Department, South Western Gas Board.

The Associations were honoured by the presence of Mr. J. T. Haynes, President of the Institution of Gas Engineers, Mr. C. H. Chester, C.B.E., Chairman of the South Western Gas Board and a Past-President of the Institution, Mr. James Carr, Deputy Chairman of the South Western Gas Board, and Mr. C. R. Ingham, Chairman of the South Western Section of the Institution of Gas Engineers.

Addressing the meeting Mr. Haynes brought greetings from the Council of the Institution of Gas Engineers and said how much the Council appreciated the views of the junior associations. The attendance at the meeting was indicative of the enthusiasm of the members, many of whom had to travel long distances. Congratulating the author on his paper, Mr. Haynes suggested that the sooner engineers appreciated the interpretation of costs, the sooner they would appreciate the accountants' point of view.

Mr. C. H. Chester extended a special welcome to the President of the Institution of Gas Engineers. He pointed out that accounting was a necessary tool of management and that the expert contributions of the four main sides—production, distribution, commercial, and accountancy—were essential to the well-being of the industry. In times of rising costs they had to have reliable figures to know where they were going.

ANOTHER NORTH THAMES COLLIER LAUNCHED

Intended as a further addition to the collier fleet of North Thames Gas Board, the s.s. *David Pollock* has been successfully launched in Aberdeen. The naming ceremony was carried out by Mrs. Edwin Bayliss, wife of the Chairman of the North Thames Gas Consultative Council.

The party at the launching (left to right) included Mr. Dawson (North Eastern Marine Engineering Co.), Mrs. Dawson, Mr. Jones (Stephenson, Clarke, Ltd.), Mr. Johnson (Hall, Russell & Co., Ltd.), Mrs. Bayliss, Mr. E. Bayliss (North Thames Gas Consultative Council), Mr. Smith (A. Hall & Co.), Mrs. Johnson, Mr. Rowstron (Stephenson, Clarke, Ltd.), Mr. McLay (Hall, Russell & Co., Ltd.), and Mr. Gardener (Stephenson, Clarke, Ltd.).

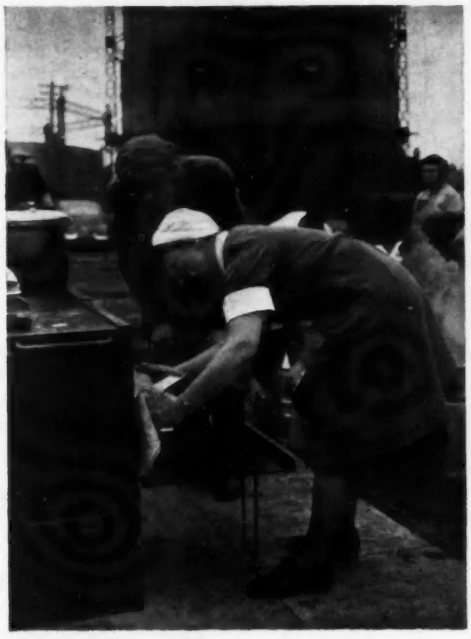
Built by Hall, Russell and Co., Ltd., of Aberdeen, the *David Pollock* is the tenth post-war launching on behalf of the Board. She is a single-screw, self-trimming steam collier with an overall length of 339 ft., and a moulded breadth of 46 ft. The vessel will carry 4,600 tons of coal in four holds suitable for grab discharge. Water ballast will be carried in the double bottom, after peak tank, large fore peak tank, and in a deep tank under the bridge. The propelling machinery will consist of a direct-heating, triple expansion steam engine of the North Eastern Reheat design developing 1,275 i.h.p. in service, and will be installed by the North Eastern Marine Engineering Co. (1938), Ltd., of Sunderland. Her crew of 24 will be accommodated in single-berth cabins.

EMERGENCY FEEDING FOR CIVIL DEFENCE

Meals for 370 schoolchildren were recently prepared and cooked in the open air as an exercise in emergency cooking. In any wartime or civilian disaster when gas and electricity supplies might be disrupted it is comforting to know that volunteers, most of them housewives, in the Romsey, Hampshire, district, are experienced in providing full course main meals for large numbers of people in only a short time.

The exercise was organised by Mr. William Coates, the Hampshire County Emergency Meals Officer, in conjunction with the local Civil Defence authorities. The general organisation of equipment and volunteers at the Romsey gasworks yard, where the exercise took place by courtesy of Mr. G. Neil, Engineer and General Manager at Southampton of the Southern Gas Board, was directed by Mr. E. H. Cuthbert, Assistant Emergency Meals Officer for Hampshire. The cooking was under the supervision of Miss G. E. Hodge, Area School Meals Organiser.

Twenty-five members of the Civil Defence Corps Welfare Section took part in the practice, most of them members of the Women's Voluntary Services. Mrs. R. C. Chambers, Mayoress of Romsey, who is also the W.V.S. Centre Organiser for Romsey Borough, Mrs. E. M. Dale, Centre Organiser for Romsey Rural District, and Mrs. E. Pugh, Deputy Centre Organiser for Romsey Rural District, gathered together the volunteers. Some of these housewives came from as far afield as Mottisfont, Braishfield, Wellow, Tinsbury, North Baddesley, and Chilworth.



In the gasworks yard at Romsey, Hampshire, Mr. G. H. Petch, Southern Gas Board Civil Defence Instructor for Southampton, watches Miss G. E. Hodge, Area School Meals Organiser, putting a tray of food into the oven of an emergency Bluff-type cooking stove. Volunteers of the Civil Defence Corps (Welfare Section) were engaged in an exercise in emergency feeding methods. (Ministry of Food Crown Copyright.)

The gasworks yard proved an excellent setting for the exercise. On the previous day tables and utensils for preparing the meal, together with the menu chart and instructions, were set up in a large, derelict building. Outside in the open yard the large scale cooking equipment of a transportable kitchen unit was assembled. It comprised a Bluff-type range, a Triplex cooker and six Soyer boilers. The actual cooking part of the exercise took place on the second day. The menu was brown stew, cabbage and potatoes, apple crumble and custard; also tea. The exercise ran smoothly and was very successful. Appetising meals were packed into insulated food containers and transported to the Secondary Modern School and the Boathouse.

Among observers at the exercise were Mr. J. C. R. Thomas, Area Civil Defence Officer, Mr. G. H. Petch, Civil Defence Instructor for the Southampton area of the Southern Gas Board, and Mr. W. F. Brooks, who is head of the Welfare Section of the Civil Defence Corps in Romsey Borough and the Romsey and Stockbridge Rural District. Representatives of the Ministry of Food were Mr. L. E. Titford, Assistant Regional Food Officer, Mr. Arthur Evans, Assistant Meals Organisation Officer, and Mr. H. B. Sims, Food Executive Officer for the Southampton District.

News in Brief

A Special Display of Radiation New World Newlyn S12/2 water heaters in the Nottingham showrooms of the East Midlands Gas Board carried the slogan '14 Gal. of Hot Water for the price of one Cigarette.'

More than 280 Employees of the West Midlands Gas Board attended the annual dinner and social of the Recreation, Social and Welfare Society at Walsall on March 26, when Mr. S. H. Lawrence, Engineer and Manager of the Walsall District, presented long-service certificates to H. W. Gregory, W. Sutton and A. Ballinger, who had each served for 25 years. He also presented safe driving certificates to 12 drivers in the employ of the Board.

The Brewers' and Allied Traders' Exhibition will take place at Olympia from October 4 to 8. A comprehensive display of plant, equipment, and materials is planned, and already it is clear that there will be many visitors from home and overseas. National beer competitions will be an important feature. There will be competitions for draught and bottled beer, and one for bottled beer from the Commonwealth. Other competitions will be for the season's best barley and hops. An innovation this year will be the Inn Sign Competition. Prizes are being offered for the best designs, and they will be displayed at the Exhibition.

N.I.F.E.S.—The headquarters of the National Industrial Fuel Efficiency Service are at 71/72, Grosvenor Street, London, W.1 (T/N: Hyde Park 9706). Asked in the House on Commons on April 5 whether the appointments had been made for the board of directors and staff of the organisation and when it was expected that operations would start. Mr. Geoffrey Lloyd, Minister of Fuel and Power, said the directors, general manager and secretary had been appointed; staff recruitment was proceeding and the service expected to start operating on May 1.

A Departure from the run-of-the-mill design of many gas service centres is provided by a small centre recently opened at Frodsham (Cheshire) by the Mid-Cheshire Group of the North Western Gas Board. Housed in part of a century-old building formerly used as the local town hall, the new centre, consisting of one room and an entrance hall, has been designed, decorated, and furnished throughout in an attractive and striking modernistic style devised by Mr. Clifford Walker, Window Display Officer in the Board's headquarters Sales and Service Division.

S.B.G.I. Silver Medals

The Council of the Society of British Gas Industries has again this year awarded silver medals to the Junior Gas Associations for the best paper presented during the year by their members at a general meeting. Thirty papers were submitted by nine Junior Gas Associations for adjudication and the following is the list of the awards:

MIDLAND: N. Calvert, for paper 'Gas Liquor in Vapour Phase and Liquid Phase Plants.'

WESTERN: J. Parker, for paper 'Fluids Handling in a Gasworks.'

MANCHESTER: D. B. Stokes, for paper 'Thoughts and Ideas on Retort House Practice.'

SCOTTISH (EASTERN): G. Cobb for paper 'The Design and Construction of the Foundation of a 750,000 cu.ft. Gasholder at Leven.'

YORKSHIRE: A. W. Field, for paper 'Ourselves and our Jobs.'

WALES AND MONMOUTHSHIRE: L. R. Starr, for paper 'The Mechanical Side of the Gas Industry in Wales.'

NORTHERN: C. H. Thompson, for paper 'Maintenance Engineering of Gasworks Plant.'

SCOTTISH (WESTERN): W. A. Green, for paper 'Some Aspects of Consumer Service.'

LONDON AND SOUTHERN: D. R. Wills, for paper 'Intermittent Space Heating.'

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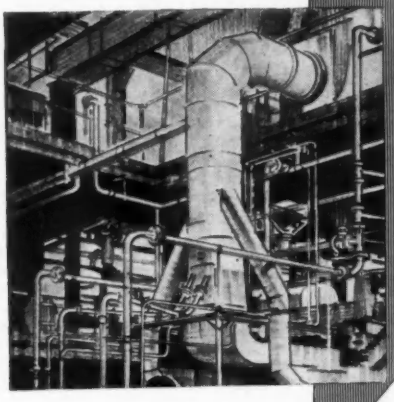

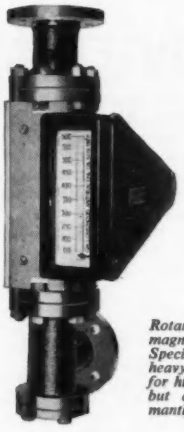

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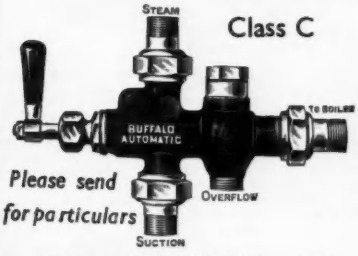

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APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

SOUTHERN GAS BOARD

CENTRAL DIVISION
READING AND DISTRICT
GAS UNDERTAKING

SHIFT SUPERINTENDENT

APPLICATIONS are invited for the position of SHIFT SUPERINTENDENT at the works of the Reading and District Gas Undertaking.

Candidates should possess the Institution of Gas Engineers Higher Grade Certificate in Gas Manufacture or equivalent qualification, and have experience in the operation of modern gas-works plant.

Salary will be in accordance with A.P.T. VI (£510-£590 per annum) of the National Joint Council for Gas Staffs.

The successful candidate will be required to undergo a medical examination and to join the Southern Gas Board's Pension Scheme.

Applications, giving full particulars, to be lodged with the undersigned not later than May 3, 1954.

F. G. SYMON,
Divisional General Manager.

King's Road,
Reading.

(*Classified Advertisements continued on page* 130)

APPOINTMENTS VACANT (ctd.)

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APPLICATIONS are invited for the position of JUNIOR TECHNICAL ASSISTANT (WORKS) at a salary of £350 rising to £450 by four annual increments of £25 subject to satisfactory service, and should reach the Managing Director, Jersey Gas Light Co., Ltd. 97, Bath Street, Jersey, C.I., before April 27, 1954.

A SENIOR ASSISTANT is required for the Research and Development Laboratory in the Heating Division of a large firm in East Yorkshire, manufacturing heating and hot water appliances. Applicants should have had experience of technical research, combustion of fuels, cast iron foundry practice, design and application of heating apparatus. Age around 30 to 35 years. Excellent prospects for the right man, who must be a keen and energetic worker, with confidence and ability to prove himself by results. Superannuation scheme. Apply in writing in the first instance, giving full details of experience, qualifications and education, stating whether married or single, and giving present salary to Box A.122, Central News, Ltd., 17, Moorgate, London, E.C.2.

WALES GAS BOARD

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APPLICATIONS are invited for the above-mentioned position at the Grangetown Works of the Cardiff Undertaking.

Candidates should possess the National Certificate in Mechanical Engineering, or equivalent qualification, and preference will be given to those having experience in the Gas Industry.

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The salary will be within Grade A.P.T. VIII, Provincial 'A' (£605-£685 per annum) of the scales agreed by the National Joint Council for Gas Staffs.

Applications stating full personal particulars and experience, giving the names of two referees, should be addressed to the Undersigned and posted so as to arrive within fourteen days of the appearance of this advertisement.

J. POWDRILL,
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WALES GAS BOARD

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Applicants should be experienced in Modern High/Low Pressure Gas Distribution Practice, including mainlaying, planning, also consumer service and showrooms. The person appointed will be expected to perform Group Distribution duties.

The successful applicant will be required to pass a medical examination (if not already a member of a Gas Board Pension Scheme) and to join the Wales Gas Board Pension Scheme.

Applications stating age, experience, professional qualifications, and particulars of training, together with the names of two referees, should be received by the undersigned not later than April 21, 1954.

A. PICKARD, M.Inst.Gas E.,
M.I.I.A.,
General Manager & Engineer.

Wales Gas Board,
Swansea Undertaking,
Oystermouth Road,
Swansea.

ENGINEER, fully experienced in modern methods of The Thermal Efficiency Testing of Hot Water Heating and Domestic Boilers and Stoves, required by large industrial firm in East Anglia. Contributory Pension Scheme and Free Life Assurance Scheme in operation. Applicants stating age, education, experience and salary required to : No. 191, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

ACCOMMODATION AVAILABLE for FIRST CLASS GASFITTER—Vacancy occurs for first class gasfitter in the SYSTON district (five miles from Leicester). Provincial 'A' rates of pay applicable, and a newly converted flat is available on reasonable terms under Service Occupation Agreement. Applications stating age, qualifications and experience to be received by the undersigned not later than Wednesday, April 21, 1954.

H. B. TAYLOR,
Divisional General Manager.

East Midlands Gas Board,
Leicester and Northants Division,
Millstone Lane,
Leicester.

EAST MIDLANDS GAS BOARD

LEICESTER AND NORTHANTS DIVISION
APPOINTMENT OF
HOME SERVICE ADVISER—
LEICESTER GROUP

APPLICATIONS are invited for the position of HOME SERVICE ADVISER with the Leicester Group Salary range £296-£448 per annum, the commencing salary to be commensurate with the capabilities of the successful candidate.

Candidates must be capable of working independently and be in possession of a recognised Diploma in Cookery and/or Domestic Science. They should be proficient in the practical demonstration of gas cooking, laundering and other appliances, and be able to advise consumers on all domestic problems involving the use of gas in the home.

The person appointed may be required to pass a medical examination, and unless already subject to a pension scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required, if eligible, to join the Board's Staff Pension Scheme within six months from taking up the appointment.

Applications stating age, experience and present position, and giving full particulars of training and qualifications, together with the names of two referees, should reach the undersigned not later than Wednesday, April 21, 1954.

H. B. TAYLOR,
Divisional General Manager.

Gas Offices,
Millstone Lane,
Leicester.
April 3, 1954.

WEST MIDLANDS GAS BOARD

BIRMINGHAM & DISTRICT DIVISION
DRAUGHTSMEN

TWO VACANCIES exist for DRAUGHTSMEN on the Staff of the Divisional Engineer.

Candidates for the positions should have a sound Engineering training and have had experience in the design and construction of any of the following :—

Gas Works Plant
Mechanical handling of materials
Structural Steel work
Civil Engineering work
Steam and Power Plant.

The salaries for the posts will be within Grade IX (£635-£735) of the National Salary Scales for Gas Staffs.

The posts are pensionable and the successful candidates may be required to pass a medical examination.

Applications stating age, present position, experience, general and technical education and certificates held, together with the names of two referees, should be addressed to Mr. J. E. Wakeford, Divisional General Manager, West Midlands Gas Board, Birmingham and District Division, Gas Offices, Edmund Street, Birmingham, 3, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON
Secretary to the Board.

WEST MIDLANDS GAS BOARD

WOLVERHAMPTON & DISTRICT DIVISION
DISTRICT INSPECTOR—
SOUTHERN GROUP

APPLICATIONS are invited from suitably qualified persons for the appointment of an additional District Inspector in the above Group. The Districts comprising the Group are Stourbridge, Cradley Heath, Rowley Regis and Halesowen. The person appointed will be required to work at any of these Districts.

A sound knowledge of domestic appliances, gasfitting and consumer service generally, with preferably some experience of public lighting, is required, and candidates should hold the City and Guilds of London Final Certificate for Gasfitting. It would also be an advantage to possess a Gas Supply qualification.

The salary will be within Grade VI (£510-£590 per annum) of the National Salary Scales for Gas Staffs.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, qualifications and experience, together with details of present and previous employment and the names of two referees, should be addressed to Mr. F. C. Briggs, Divisional General Manager, West Midlands Gas Board, Wolverhampton and District Division, Kensington House, Bath Street, Dudley, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

WALSALL & DISTRICT DIVISION
DISTRICT INSPECTOR
WEST BROMWICH

CANDIDATES must have a sound knowledge of domestic appliances, gasfitting and consumer service generally, and should be capable of preparing estimates and advising consumers on all aspects concerning the domestic utilisation of gas.

The successful applicant will be responsible to the District Sales and Service Superintendent for the maintenance of satisfactory consumer relationships and the development of the sales of domestic appliances for a section of the District comprising approximately 10,000 consumers.

The salary for the post will be within Grade VI (£510-£590 per annum) of the Salary Scales of the National Joint Council for Gas Staffs.

The post is pensionable and the successful applicant may be required to pass a medical examination.

Applications stating age, qualifications and experience, together with the names of two referees, should be addressed to Mr. E. Hardiker, Divisional General Manager, West Midlands Gas Board, Walsall and District Division, Walsall Factory Estate, Tame Bridge, West Bromwich Road, Walsall, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

PLANT FOR SALE

WALES GAS BOARD

CONWAY UNDERTAKING have the following Waste Heat Boilers for disposal. 1—Spencer Bonecourt Induced Draught Waste Heat Boiler. Capacity 1,200 lbs. steam per hour fitted with duplicate Weir Pumps and Turbine driven Fan.

1—Galloways Natural Draught Waste Heat Boiler Capacity 1,500 lbs per hour. Further particulars can be obtained from the Engineer and Manager, Wales Gas Board, Conway Undertaking, Castle Street, Conway.

SCRAP GAS METERS WANTED!
A SPEEDY SERVICE
Sell to those best suited to deal with them.
TOP PRICES PAID
Collection arranged from anywhere in U.K. Truck Loads to our own private siding, Beddington Lane, Southern Region.
Sell to MITCHAM SMELTERS LTD
ROMETAL WORKS, RED HOUSE ROAD, MITCHAM ROAD, CROYDON SURREY
TELEPHONE THOrnton Heath 6101 PRIVATE BRANCH EXCHANGE

for SAFETY

ON GASWORKS

for the regular purging of purifiers, for repairs to gas holders and other gas works plant this Holmes unit will supply Inert Gas with economy and efficiency ensuring safety both to plant and personnel.

FOUNDED 1850
HOLMES
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INERT GAS GENERATORS

for Purging Gas Works Plant

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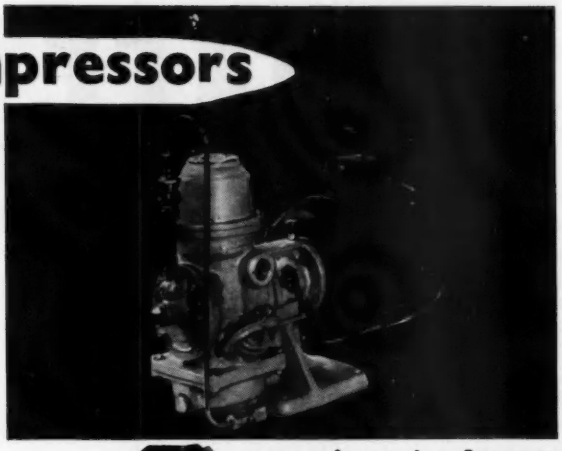
Telephones: Huddersfield 5280; London Victoria 9971; Birmingham Midland 6830

C 1336

industrial gas compressors



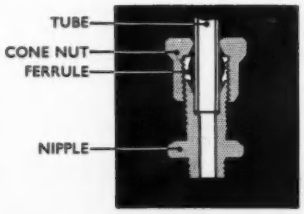
FOR COMPRESSING AIR OR GAS SUPPLIES USED FOR FURNACE HEATING, METAL MELTING, BRAZING, SOLDERING BITS, LAUNDRY IRONS, ETC.

DIRECT COUPLED COMPRESSORS (see illustration right) are fitted with automatic internal by-pass valves and lubrication systems. They are direct coupled to Keith Blackman motors. Type OA compressors in this range occupy a floor space of only 18" x 7½".
CAPACITY RANGE: 100 to 750 cub. ft. of gas or air per hour at 3 lbs. per sq. in. pressure.

TYPE 4 COMPRESSORS (not illustrated) are also fitted with automatic internal by-pass valves and lubricators. The complete unit includes motor and drive on a common bedplate, all of Keith Blackman manufacture.
CAPACITY RANGE: 500 to 20,000 cub. ft. of gas or air per hour at 3-5 lbs. per sq. in. pressure.
AREA OCCUPIED: from 9¼" x 16½" to 61" x 27".

DID YOU KNOW?

KEITH BLACKMAN have been making compression joints for many years and the present design embodies features developed as a result of this long experience. *Notice that the shape of the ferrule is such that the joint is made without unduly stressing the tube.*



serving to burn

Note: the four burner heads (right) are for high pressure gas, or low pressure gas and air blast.

LEFT: "Fishtail" type burner with two-armed stamped pattern injector for heating liquid in tanks by submerged combustion tubes. For use with low pressure gas supplies. **Size Range:** 1", 1¼", 1½", 2" and 2½" outlets. **Capacity Range:** 45-280 cub. ft. of gas per hour.

Brass non-blow-off head types: deal with 5 to 10 cub. ft. of gas per hour.

Stainless steel, "F" type head, burner: deals with 8 cub. ft. of gas per hour.

Perforated head type burner: deals with 10 to 15 cub. ft. of gas per hour.

INDUSTRIAL GAS EQUIPMENT

524

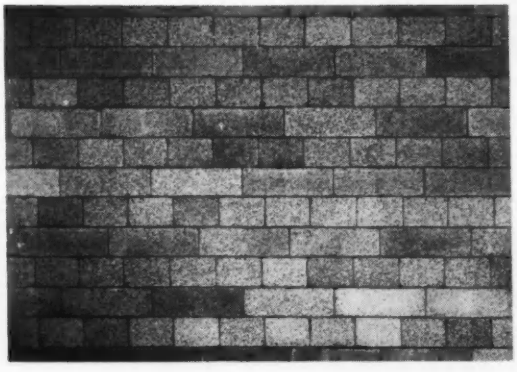
Keith Blackman LIMITED

MILL MEAD ROAD, TOTTENHAM, LONDON, N.17

'Phone: Tottenham 4522 (twelve lines). 'Grams: "Keithblac, Norphone, London."

BRANCH OFFICES: AT MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW, NEWCASTLE ON TYNE, PENARTH near CARDIFF AND BELFAST

STEIN *Refractories*



THE STRENGTH OF FURNACE BRICKWORK—and durability of the furnace lining in service is greatly controlled by the joints. Well shaped bricks of accurate size, use of a Refractory Cement correctly chosen for the purpose, combined with good bricklaying (which means thin, tight joints) gets a furnace lining off to a good start. A Refractory Cement should be selected just as carefully as the brick with which it is to be used. We are always very willing to give our advice on the best type of Cement for particular applications.

MAKSICCAR FIRE CEMENT · MAKSICCAR II · NETTLE CEMENT · STEIN SILLIMANITE CEMENT · STEIN HIGH ALUMINA CEMENT · STEIN CHROME CEMENT · STEIN CHROME-MAGNESITE CEMENT · STEIN MAGNESITE CEMENT · BLUEBELL SILICA CEMENT · THISTLE AND STEIN FIRECLAYS · GROUND GANISTER

JOHN G. STEIN & Co LTD Bonnybridge, Scotland

TEL: BANKNOCK 255 (3 LINES)

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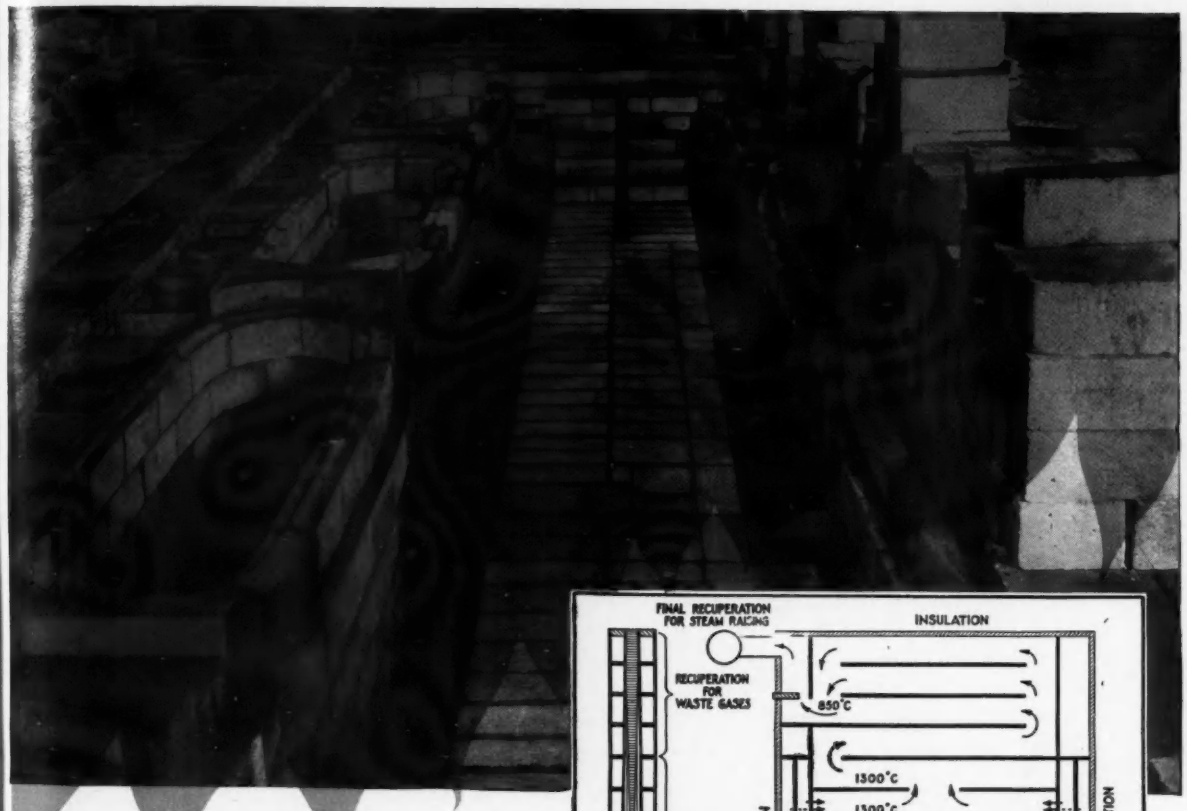
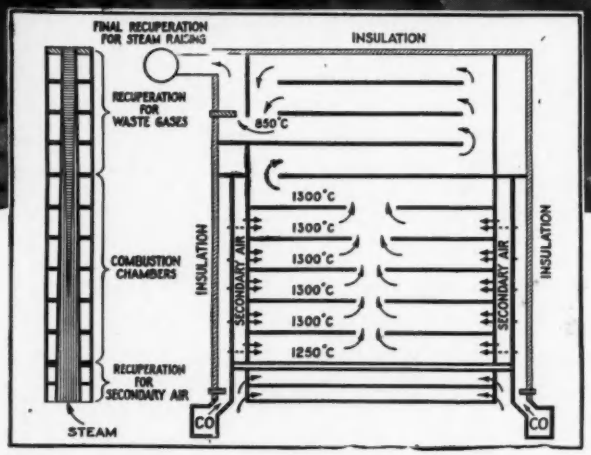
"Balanced Heating"

MEANS ECONOMICAL GAS—MAKING





Great reductions in the amount of fuel required for the carbonization process have been recorded in the "Balanced Heated" settings of the Glover-West continuous vertical system.

This is due to two main factors. The retorts are heated by *primary* combustion of producer gas which enters the combustion chambers at *both* sides of the setting. Even heating of the retorts ensures maximum utilization of heat and eliminates high local temperatures and fuel wastage.

In addition, improved control of individual combustion chamber temperatures ensures maximum gas production from all coals.

* *Illustration shows a "Balanced Heated" setting under construction.*

West's Gas IMPROVEMENT CO. LTD.

ALBION IRONWORKS · MILES PLATTING · MANCHESTER 10

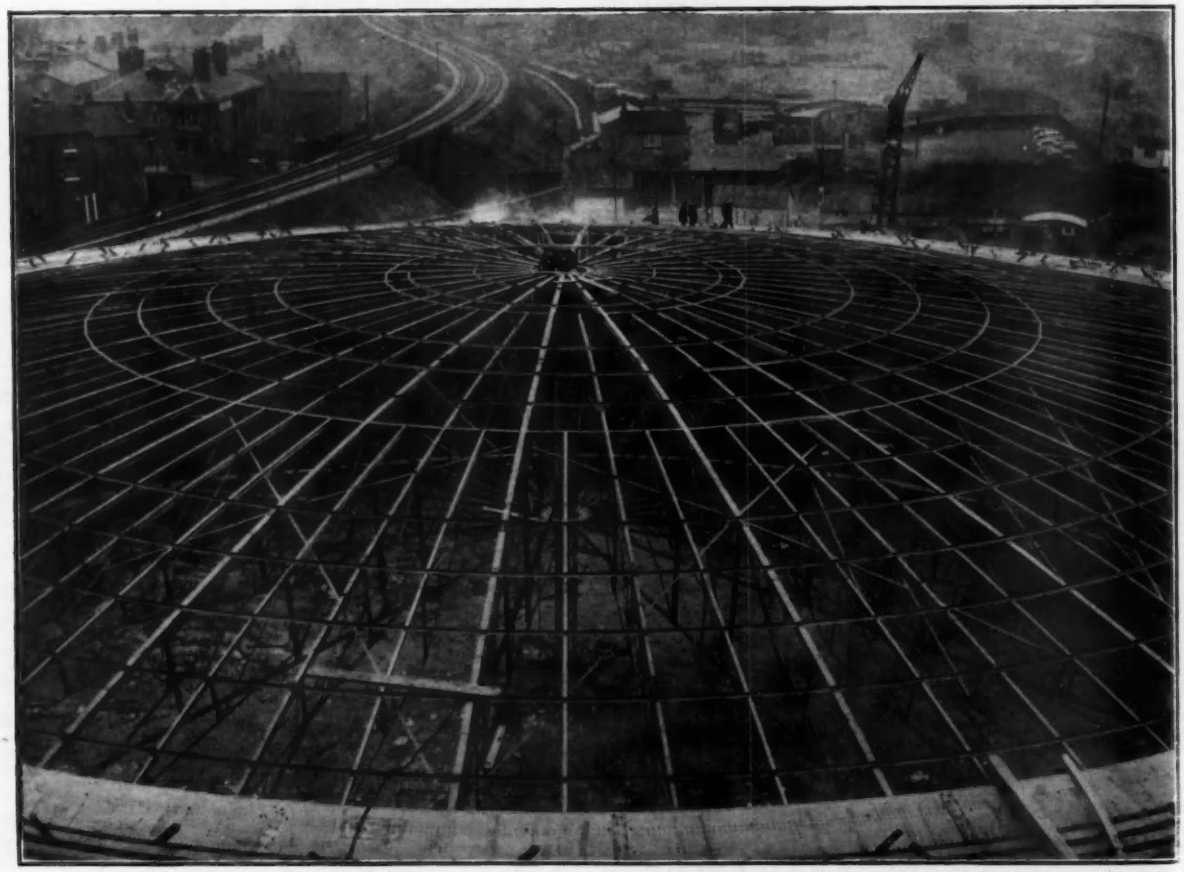
Telephone: COLlyhurst 2961. Telegrams: Stoker, Manchester.

London Office: Columbia House, Aldwych, W.C.2. Phone: HOLborn 4108-9 Grams: Wesgasco, Estrand.

The BIG TOP

NOW IN AN ADVANCED STAGE OF CONSTRUCTION

Another 8,000,000 cubic feet GASHOLDER for SHEFFIELD



Photograph by courtesy of the East Midlands Gas Board, Sheffield.

NEWTON CHAMBERS

& CO. LTD., THORNCLIFFE, Nr. SHEFFIELD